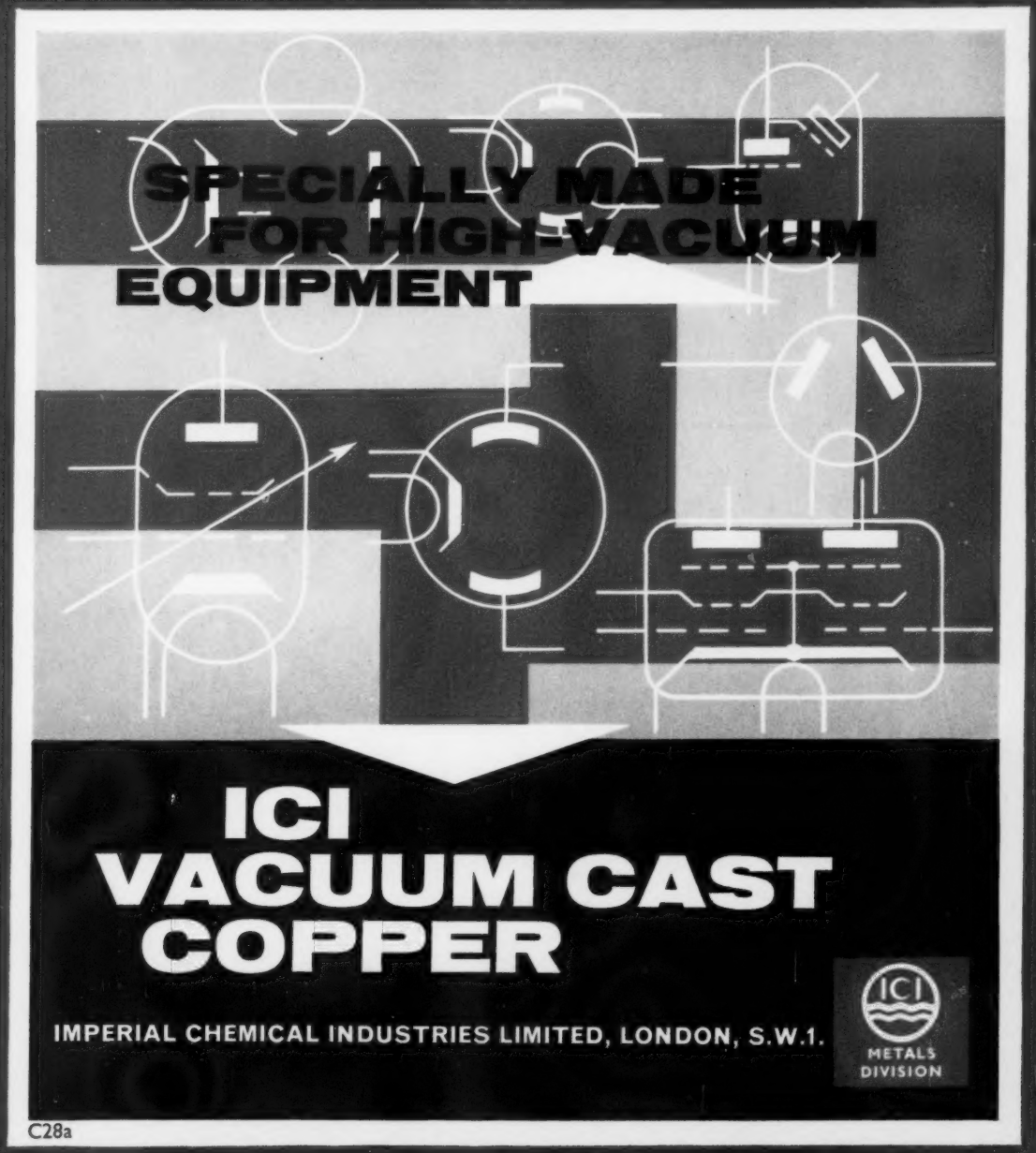
20 JANUARY 1961

METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS



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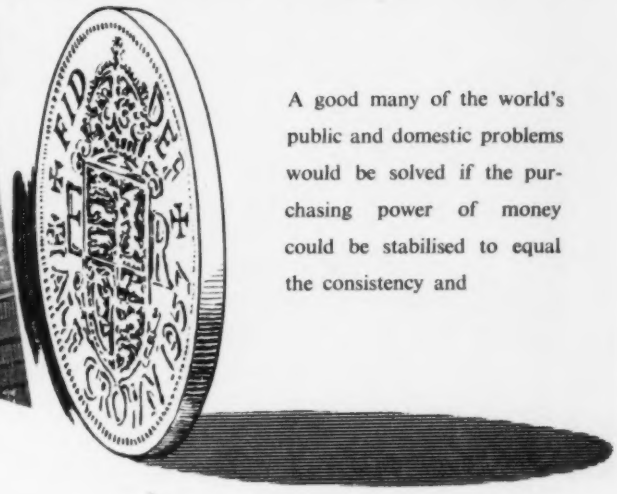

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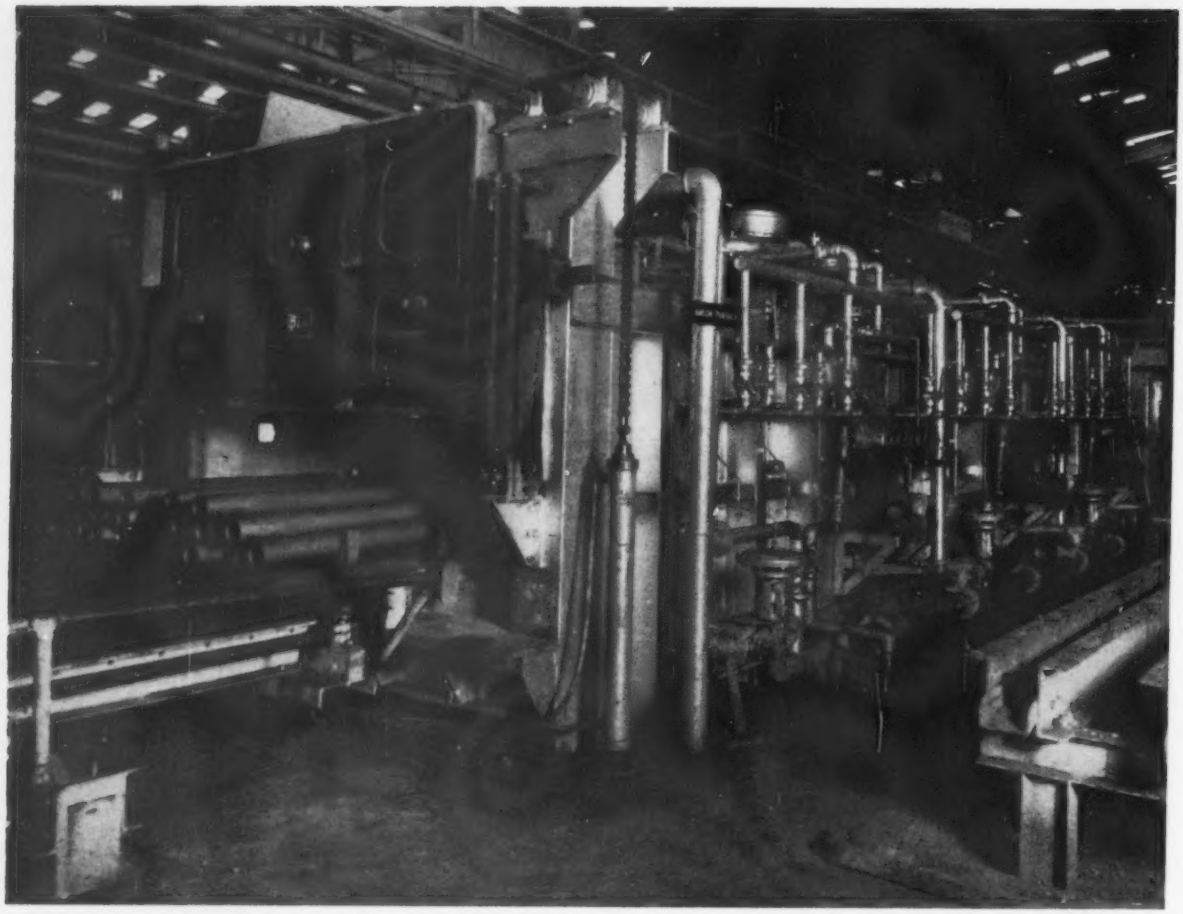

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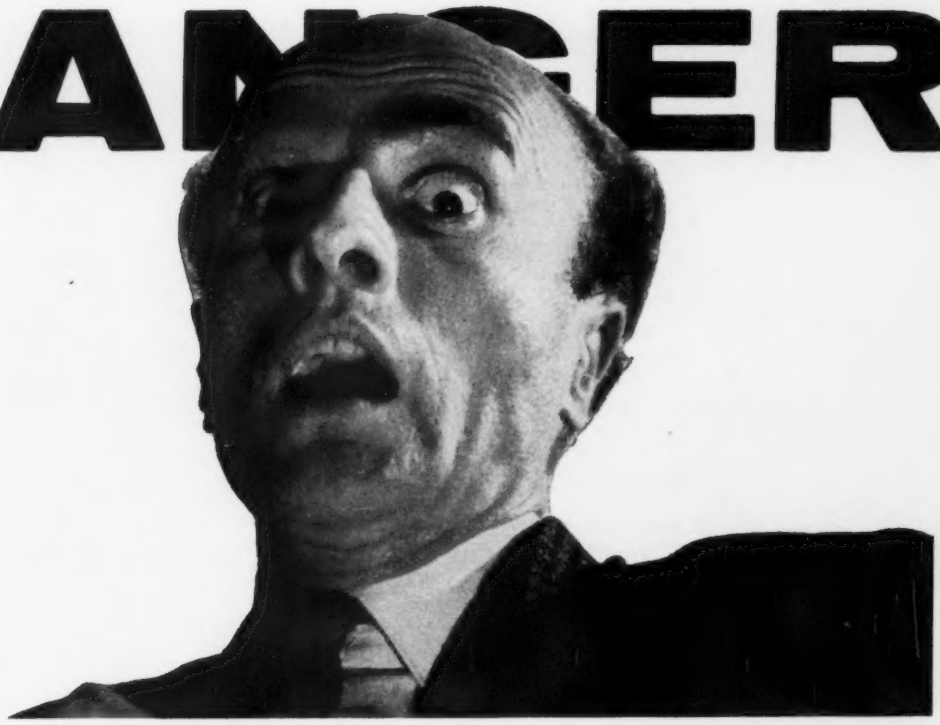

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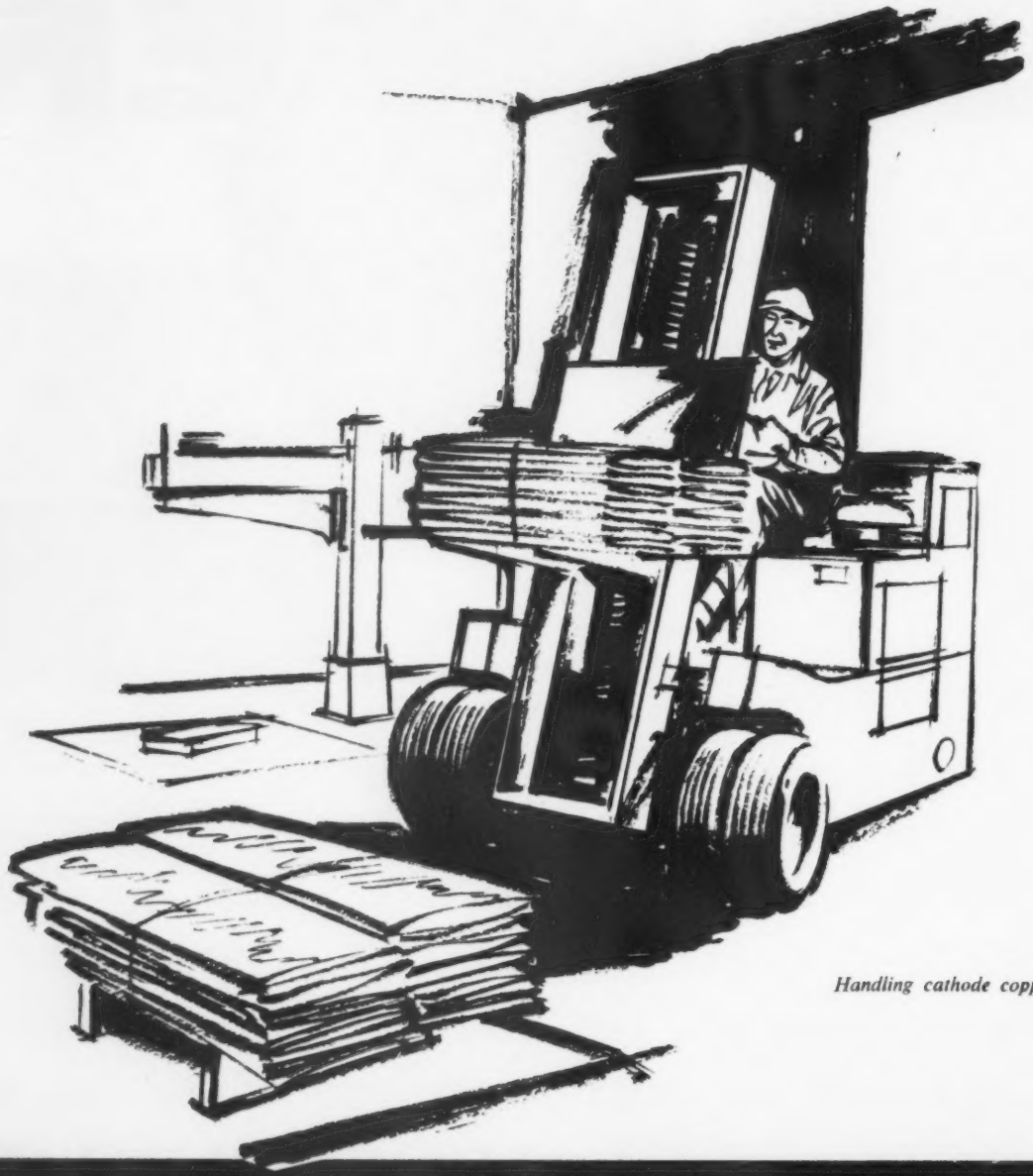

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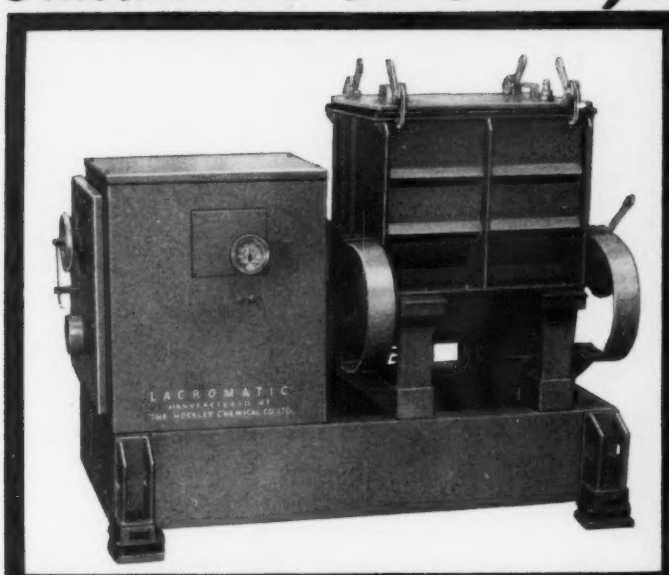

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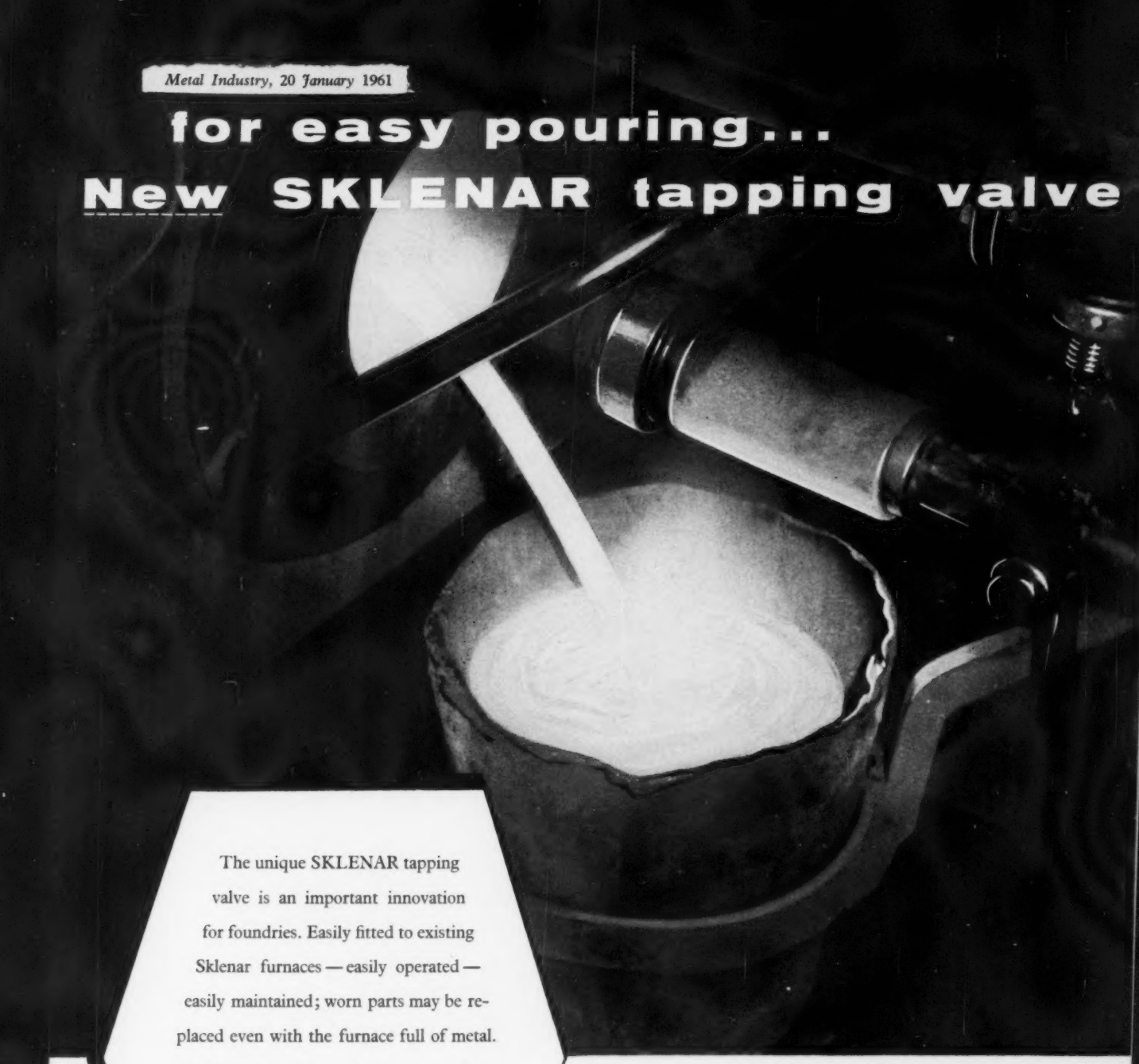

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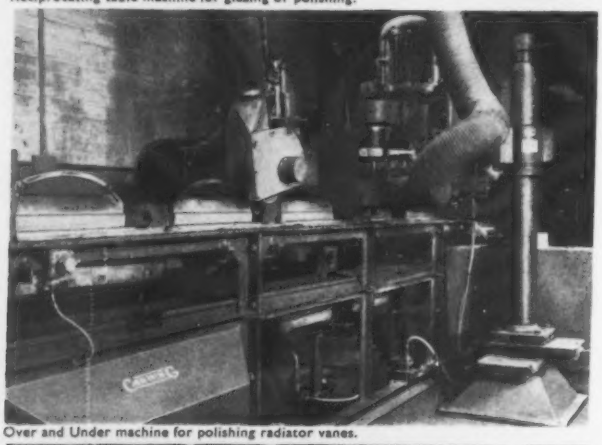
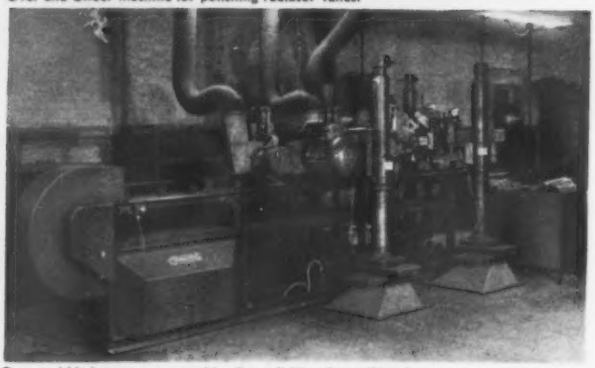


Over and Under machine for polishing radiator vanes.



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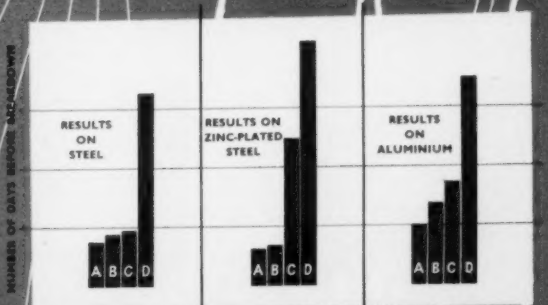

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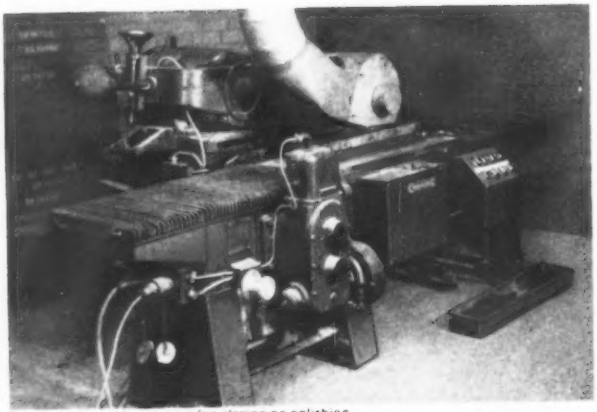

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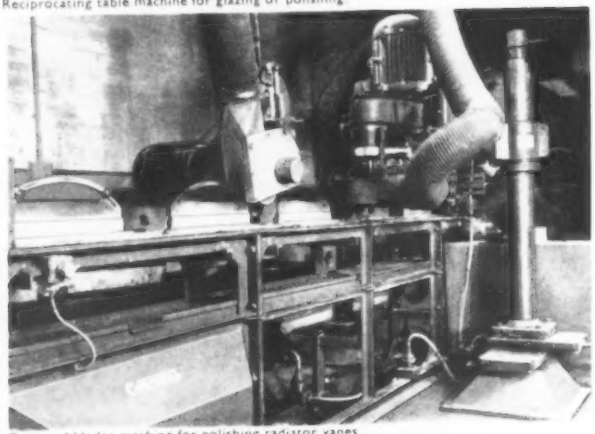
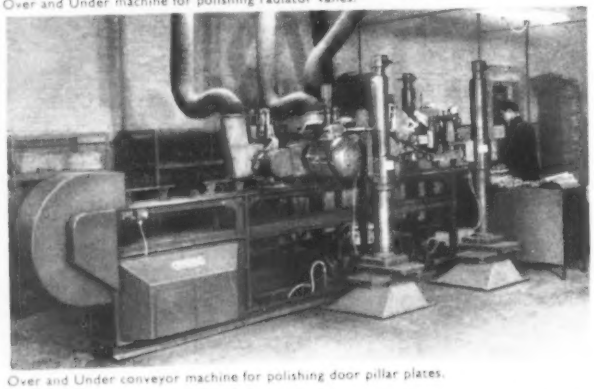


Over and Under machine for polishing radiator vanes.



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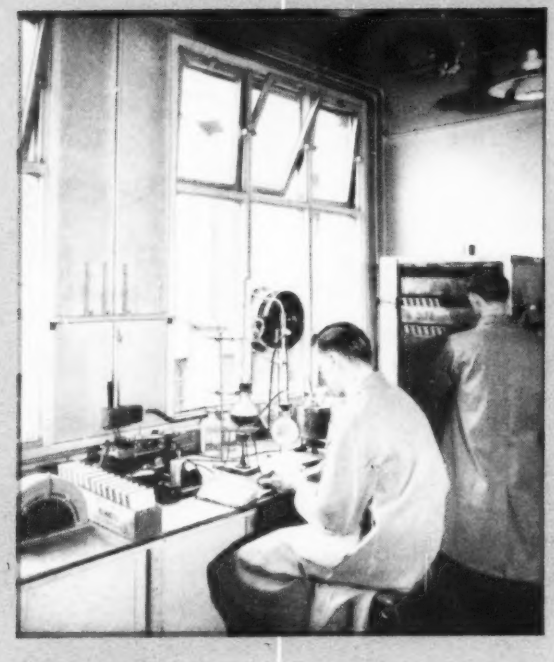

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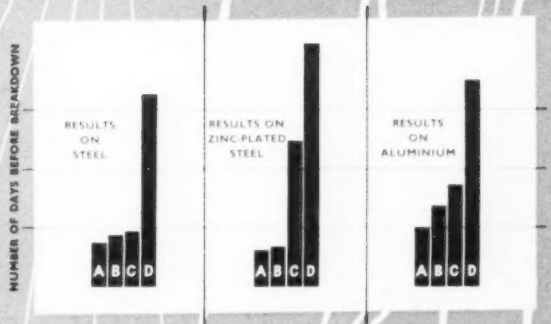

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METAL INDUSTRY

FOUNDED 1909

EDITOR: L. G. BERESFORD, B.Sc., F.I.M.

MANAGING DIRECTOR: ARTHUR B. BOURNE, C.I.Mech.E.

20 JANUARY 1961 VOLUME 98 NUMBER 3

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METAL INDUSTRY

VOLUME 98 NUMBER 3 20 JANUARY 1961

Sell or Sink

ONCE again British industry has been the recipient of many exhortations to "Sell or Sink". During the past decade, British exports have risen by more than 55 per cent, but at the same time our share of world exports has declined steadily from 25·5 per cent to 17·3 per cent. To some degree this is explained by the fact that other countries, especially Germany and Japan, have regained their share of the market. Many British analysts, however, do not feel that this tells the whole story. They blame also the level of British prices and the attitude of our business men towards foreign markets, and feel that, until changes occur, our share of the markets will continue to fall. Historically, this country consistently has had a large surplus of what is termed "invisibles"—expenditure on shipping and earnings of that industry, income from foreign investments and the like; recently, however, this margin has been declining.

Impatient at the continued holding back of economic growth because of concern for the balance of payments, critics of recent Government policy urge a different course. They argue that since export performance in the long run depends on having modern, competitive industry, and since domestic industrial investment is dependent largely on the course of home demand, an ultimate solution to the problem can be found only through pursuing a high rate of economic growth despite short-term consequences to the balance of payments. However much may be made of this line of reasoning, the Government cannot ignore the need to maintain foreign confidence in sterling. When short-term foreign money stops coming to London—and the movement has already abated —the deficit on current and long-term capital account will no longer be masked and the reserves of gold and convertible currencies will decline. Determined to keep any such development within moderate bounds, any Government is likely to avoid moves which might aggravate the payments deficit.

Last week British industry was made aware of a new company, just formed, which is to supply what is known as a "sales factoring service", which will provide in home and overseas markets the service of salesmanship. Such a service is better known in the United States, where a similar organization exists. The basis of this "service" is one of full credit insurance, book-keeping and debt collection for the seller, although this may be supplemented by the discounting of debts to assure immediate payment. Where overseas business is concerned the company would also supervise Customs formalities and help with the choice of sales agents and customers. The charge for this factoring service, it is understood, would range between 1 and 2 per cent of turnover. It is said that the development of this business will make it easier for the smaller firms to enter the export markets. For exporters, a most important question will be whether their business calls for the supplementary services offered in addition to those to be obtained from the Export Credits Guarantee Department.

Out of the MELTING POT

One at a Time

PERFORMING a number of operations at one and the same time may save time, but adds complications to the apparatus, the machine, the tools, etc., required for the job. The principle of combined operations is so deeply ingrained, however, that only very seldom does one meet with attempts to balance it against the added complications which it involves. Where the principle is definitely harmful is in those cases in which the complications involved in performing several operations simultaneously are sufficiently great severely to limit the use of the particular process or to rule it out altogether. Yet even in such cases, the influence exercised by the guiding principle is so strong that it effectively suppresses any consideration of the possibility of splitting up the over-complicated process into separate operations and performing them one at a time. Performing the operations separately will take longer, but would simplify matters and very often would give the same or even better results than the one-stage process, assuming, that is, the latter is practicable. An example of such a process and of the stultifying effects of the principle of combined operations is the hot pressing of powdered materials ranging from metals to refractory oxides. The process consists of heating and pressing the powder in a die. Simple enough, until one comes to consider how to heat the powder to, say, 1,900°C. and what material to use for the die. Applying the principle of separate operations, matters could perhaps be simplified by performing the heating of the powdered material as a separate operation, the heated powder being transferred to the die (which may need preheating, though to a much lower temperature than the powder) and quickly pressing the hot powder. Alternatively, forming might be separated from the operation of applying pressure to the hot material: cold pressing and sintering being followed by heating in a suitable medium under pressure. Experiments in which specimens of rock salt and copper containing various types of defects and unsoundness were heated under moderate gas pressures of up to 50 atm. showed that a marked improvement could be achieved, the crystals of rock salt becoming transparent, and the copper developing a denser structure.

Double Treatment

UNTIL the arrival of atomic energy and of the various solid-state electronic devices, the purity of metals produced electrolytically was regarded in most cases as adequate and, by comparison with the purity of metals produced by furnace smelting, as excellent. It was only in the aluminium industry that satisfaction with the results of the electrolytic reduction process (in spite of the steady improvement in them, which resulted in a gradual improvement of the purity of commercial aluminium) did not lead to their being regarded as sufficient. A process was developed in which the commercial metal was subjected to a second refining electrolytic treatment, the process being operated on a scale that made the refined super purity aluminium available as an entirely new commercial grade of the metal. With other metals, circumstances were all much less propitious to the development of further electrolytic refinement treatments. With beryllium, for example, one always had the impression that any idea of further refinement would have been viewed as rank ingratitude, given the fact that such an unusual metal, for which there were no immediate large scale applications, was made available at all, as a result of an electrolytic process which was quite difficult enough, thank you. This attitude became untenable once the atomic energy industry began to voice its demands for highly pure materials, including beryllium. Details of the development of an electrolytic process as a means of refining commercial beryllium have recently been published. After struggling through the difficulties associated with the laboratory and pilot plant operation of electrolytic processes with fused salt electrolytes, the development was successfully carried through to the works scale, on which the same type of cell as that employed for the electrolytic production of beryllium, an electrolyte of the same composition (40-50 per cent beryllium chloride and 60-50 per cent sodium chloride) and an anode consisting of pressed beryllium rings threaded on to a graphite rod were used and large crystals of beryllium were deposited on a nickel cathode. The purity of the metal recovered, after the cell had settled down, was equal to that of beryllium purified by a single vacuum distillation.

But Not Last

NECESSITY being the mother of some inventions, such inventions are perhaps almost more interesting as indications of the various necessities than for their own sake. Such patents, furthermore, provide indirect evidence that other earlier suggestions of how to meet some particular necessity have not proved really successful. They may also display ingenuity in working their way round earlier suggestions in order to achieve much the same, presumably, successful, result. Such circumnavigation is certainly not the aim of yet another suggestion for the manufacture of improved blades for gas turbines and the like. Reading along and between the lines of the patent specification, one realizes that the inventors were aware of the cost and weight of blades made of special alloys resistant to heat and corrosion, the brittleness of ceramic blades, and of the shortcomings of cermet materials. Their suggestion is based on the idea of combining the advantages of ceramic and metallic constituents to a much more limited extent than that to which they are combined (it is hoped) in cermets. The metal (a heat-resistant alloy steel) is used in the form of a longitudinal insert or core which is formed approximately to the shape of the cross-section of the turbine blade and extends axially through it. The outer portion of the blade is made of ceramic material, either in one piece or, preferably, in the form of a number of flat pieces. Each of these has a cavity corresponding to the cross-section of the metallic core. The ceramic pieces can thus be fitted on to the core, a stack of them being built up and held tightly on the core. Thus, yet another way of combining a metal and a ceramic has been pointed out. Time and the appearance of yet other suggestions will show if further improvements in ways and means of combining such materials (always assuming they have to be combined) are possible.

Skimmer

THEIR APPLICATION TO METALLURGICAL FAILURES IN AIRCRAFT

Investigational Techniques

By D. A. RYDER, M.Met., Dip.Phys.Met., A.C.T.(Birm.) A.I.M.

(*Continued from* METAL INDUSTRY, 13 *January* 1961)

DURING 40 years of failure investigation, over 75 per cent of the specimens examined by George[1] failed by fatigue. Fatigue failures are a particular problem in aircraft where the designer must limit the weight of his structure while endeavouring to maintain its strength.

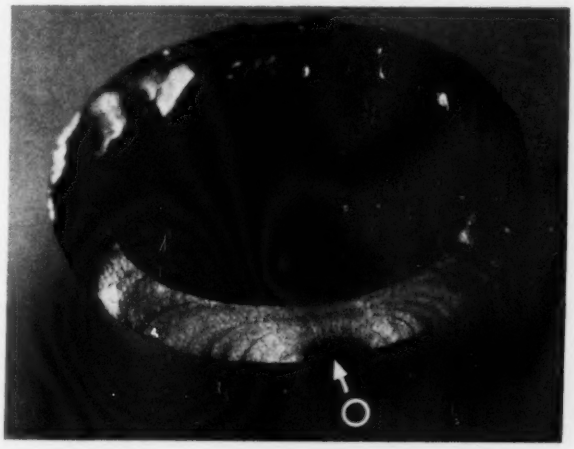
Airframes are complex structures and it is impossible entirely to avoid geometric and built-in stress concentrations which may be additive to the design loads. In any case, the designer has a difficult task in assessing the loads to which his aircraft will be subjected. For example, turbulence is generally worst at low altitudes. A short haul aircraft will be subjected to more fluctuations of stress due to take-offs and landings than a long range machine. Corrosive attack, which can accelerate fatigue failure, is more severe in the tropics than in Europe. In view of the complexity of the variables, it is not surprising that the fatigue problem is still of vital importance. When fatigue failures do occur, their diagnosis depends largely upon inspection of the fracture. A classic fatigue fracture is shown in Fig. 14. This is readily recognizable by: (a) the classic tide marks which represent successive positions of the propagating crack; (b) the absence of ductility in the region of fatigue fracture; (c) the progressively coarser texture of the fracture surface as the crack progresses.

Besides recognizing fatigue failure, the fracture may provide other evidence. The centre about which the tide marks are roughly circumferential is the origin of the fracture. "Fir tree" patterns are also observed on fatigue fractures, and the apex of the tree may again be the origin of the fracture. If the crack front has changed the sign of its curvature during propagation, the "fir tree" may, however, point to the region of final tension.

The Stress System

It is usually possible to assess the type of fluctuating stress that has produced failure. This is because the fatigue crack propagates on a plane

Right: Fig. 14—Classic fatigue fracture with well developed "Tide Marks" roughly circumferential about the origin "O"



Below left: Fig. 15—Fatigue fracture of a rotating cantilever. Two areas of fatigue have developed from origins O_1 and O_2. The plane of the fracture was normal to the major tensile axis of the specimen

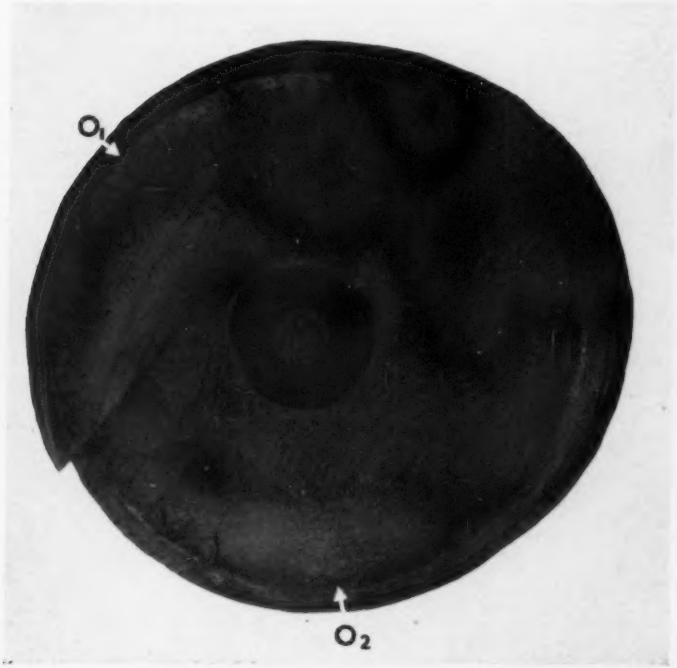


Fig. 16—Torsional fatigue fracture of a steel propeller shaft showing helical fracture surface

Left: Fig. 17—Steel bolt fatigued in fluctuating shear

Left: Fig. 18—Lug fatigue specimen in which the crack has propagated on a plane of high shear stress

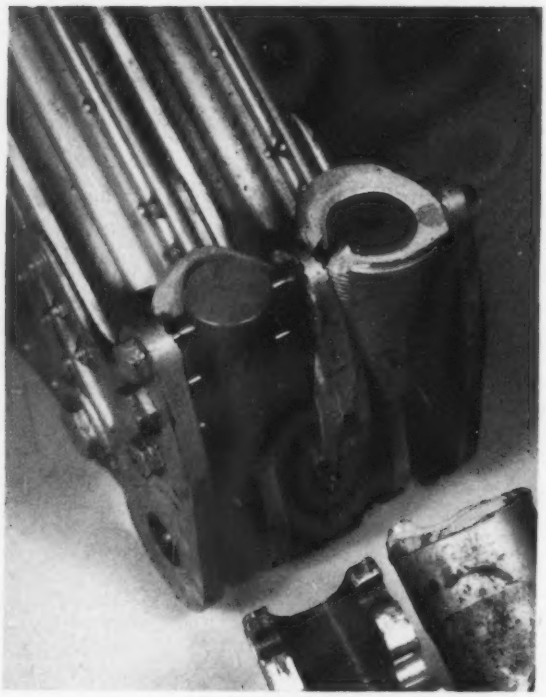


Fig. 19—Fatigue fracture of a tubular spar at the geometric stress concentrator resulting from the ends of the internal plugs coinciding with the ends of the serrated hob plates

normal to the maximum resolved tensile stress in the specimen. This is shown to be so for a rotating cantilever (Fig. 15), where the fracture surface is normal to the major axis of the shaft. A component that failed under fluctuating torsional stresses is shown in Fig. 16. Here the fracture surface is helical and again at right angles to the direction of maximum resolved tensile stress. A rather unusual case of a bolt which fatigued under the influence of fluctuating shear stresses is illustrated in Fig. 17. The fracture surface is conical and again normal to the axis of resolved tension. A fatigue crack may sometimes propagate on a plane of high shear stress. Recently, Stubbington[3] has shown this to occur in certain conditions with an aluminium-zinc-magnesium alloy tested in corrosion fatigue. It would seem that this mode of propagation is perhaps characteristic of very low magnitude fluctuating stresses. However, Fig. 18 shows one of a series of pin joint specimens fatigue tested in air at a high stress level (8 tons mean stress ±7 tons, cycles to failure 11,140), and the fracture has propagated at 45° to the axis of tension, i.e. in the maximum shear direction. This case is particularly interesting, as the other specimens in the series tested at lower stresses showed normal propagation.

Stress Concentrations

In a great many cases, the fatigue crack that has caused failure of a component is found to have begun at some geometric stress concentration. The adverse effect of machining marks and sharp changes of section are well known, yet a surprisingly large number of service failures are still caused by them. An example of a built-in stress raiser in a tubular wing spar is shown in Fig. 19. The thick walled tube was serrated on its outer wall and similarly serrated hob plates were attached to it by transverse bolts. The tube ends were plugged by a fitting which acted as an attachment lug and also prevented flattening of the tube. Unfortunately, the plug terminated at a point coincident with the edge of the hob plate and the last serrations on the tube. Fatigue failures of the tube occurred at this large change of section.

Fig. 20—Aluminium alloy pin joint lug fatigued in fluctuating tension. The fracture origin at "O" is associated with heavy fretting damage produced by a steel side plate

Fretting Fatigue

Attrition, due to repeated small relative movement between mating surfaces in intimate contact, is called fretting. The exact mechanism of the process is not understood, but it is well known that fretting can reduce fatigue life by a factor of as much as 10. In most

(Continued on page 52)

Finishing Supplement

Versatile Automatic Polishing

EQUIPMENT FOR FINISHING WIDE VARIETY OF AUTOMOBILE TRIM COMPONENTS

AUTOMOBILE production, as it is customarily envisaged, involves the manufacture of hundreds of thousands of parts of many types and of a wide variety of metals. Thus, for all popular makes of cars, high speed production on the flow-line principle has become the accepted means of achieving the high quantities required at competitive cost. Cost, however, is not the only, and may not, indeed, be the first, consideration in the manufacture of cars outside the popular range, and at Jaguar Cars Limited, of Coventry, quality of material and finish play an important part. This was emphasized in an earlier article in which the new plating lines were described (see METAL INDUSTRY, 23 December, 1960, p. 515).

In association with the new plating shop, an automatic polishing shop has been equipped to deal with the very high quantities of such small items as dome nuts, trim strips and the like, and some of the parts of irregular shape which justify specialized equipment. All the polishing machines installed are manufactured by W. Canning and Co. Ltd. Dome nuts are polished prior to plating on an automatic rotary machine with four polishing heads. The nuts are carried in jigs on the rotary table so that each nut rotates on its own axis as it passes successively beneath the four polishing mops. The machine has six stations and gives a production of some 360 nuts/hr.

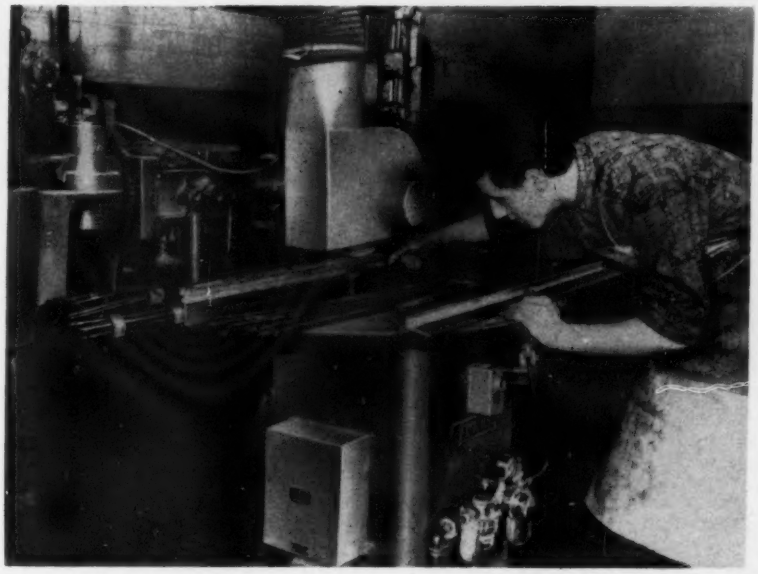


Fig. 1—Single head machine for polishing irregular shapes such as long curved strips of beading

The work comes straight from the machine shop, and the four polishing heads are fitted with mops automatically fed with composition. The different grades of mops and composition used on each head enable the finished article to be taken from the unloading station and transferred direct to plating racks in the plating shop.

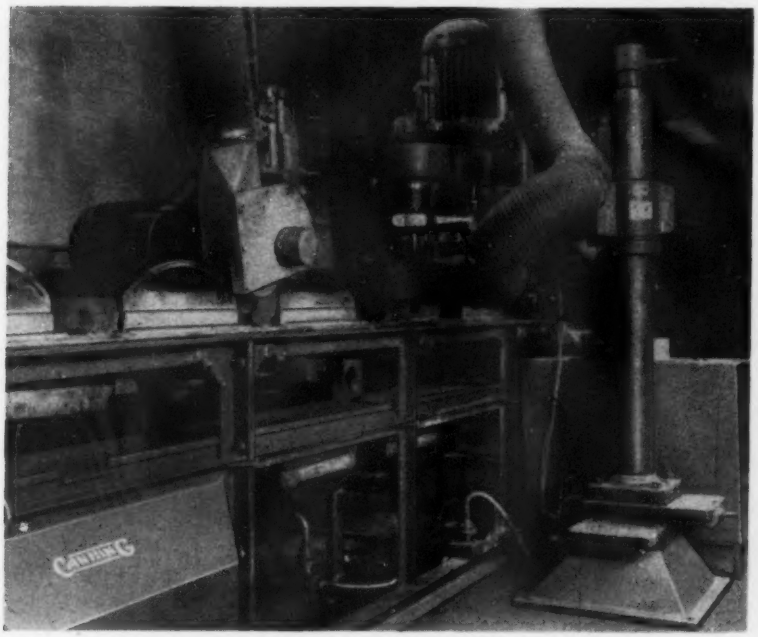
Another machine, similar in type, but having eight stations and three polishing heads, is used for larger dome nuts.

For irregular shapes, especially long curved items of trim such as brass beading, two machines each with a single polishing head have been adapted (see Fig. 1).

These are termed "irregular" shape polishing attachments and are ideal for handling work of this type, which is normally difficult to handle owing to its shape and nature. Each attachment is fitted with a pressure roller and a driven roller, both rubber covered, and the work is placed on simple work fixtures carried on T section angle, which feed between the rubber covered rollers at approximately 9 ft/min. The work passes beneath an adjustable polishing head and only one pass is needed to give a finish ready for plating. Whilst one trim is being polished, the operator is preloading a second work fixture, thus ensuring continuous output.

There are two conveyor type machines. One of these is equipped for polishing brass radiator vanes (see Fig. 2). These are, in effect, curved channels which have to be polished all over the exterior surface prior to

Fig. 2—Conveyor type machine polishing brass radiator vanes



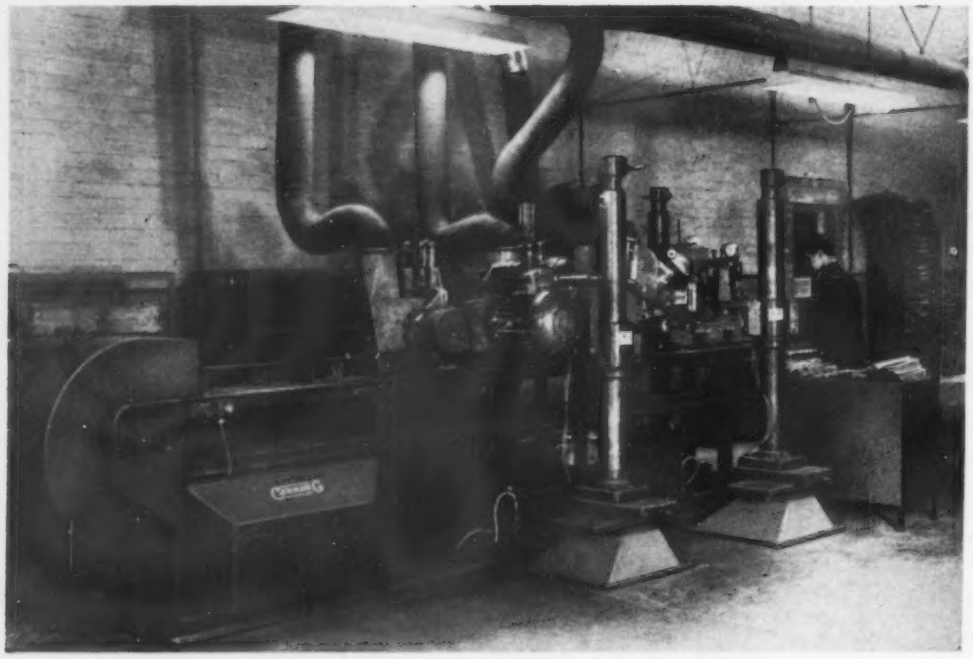


Fig. 3—Conveyor-type machine with four polishing heads, equipped for handling long straight flat work

assembly and plating as a complete grille. For this operation, a Canning "over and under" in line machine has been equipped with fixtures for holding the component and three "floating" or "follower" type heads are utilized for polishing the areas involved.

The radiator vanes vary in length, but the radius is consistent and the work fixtures are adjustable so that any size of vane can be polished on the same fixture with the same mop setting. No. 3 polishing head polishes the curved area of the article; cam formers operating in conjunction with rollers enable the polishing head to traverse the curved area at a consistent pressure.

The second conveyor is at present being used to polish straight, flat work and is similar in principle to the first conveyor, except that it is slightly longer and has four polishing heads (see Fig. 3).

On each conveyor, one operator loads and unloads at one end of the conveyor and polishing composition is applied automatically.

The conveyors have an infinitely variable rate of travel between 3 ft/min. and 15 ft/min. and outputs are very considerable.

For steel arm-rest links, small plates and other flat components, a compact reciprocating table has been installed, this being complete with a balance type polishing head also fitted with reciprocating mechanism to eliminate mop lines (see Fig. 4). This table has a 3 ft. stroke which is infinitely variable in both directions between 3 ft. 6 in. and 13 ft. 6 in/min. The length of stroke can also be varied and, where necessary, the table can be stopped altogether or allowed to reciprocate over a small area for the purpose of concentrating on bad marks in the metal.

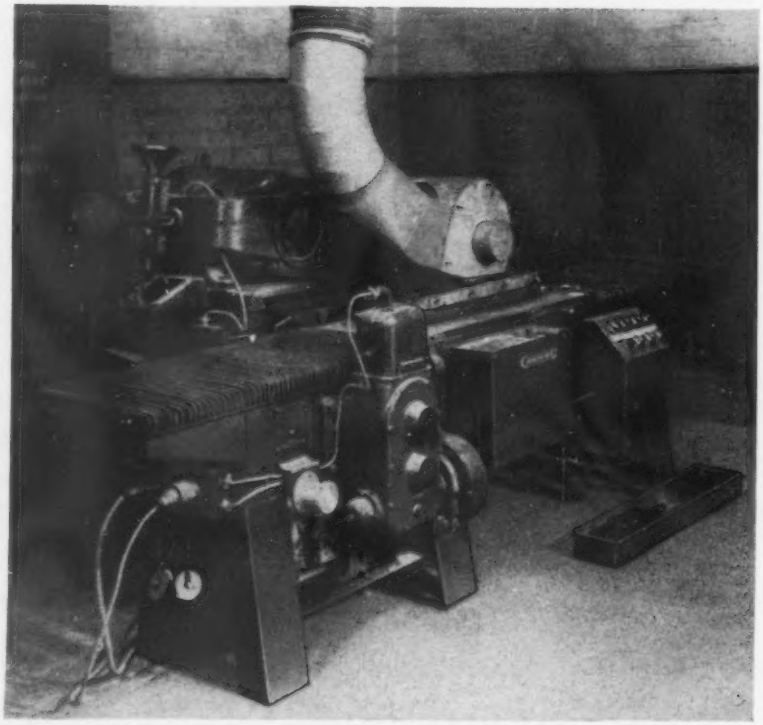
A magnetic chuck is used to carry the steel work, and mechanical fixtures are used to carry ash trays, etc.

A second, larger, machine is also installed, having an 8 ft. stroke, for such work as bumper bar strip before forming and long lengths of extrusions, etc. This machine has a fully adjustable banding head suitable for carrying abrasive bands up to 10 in. wide.

Finally, there are two double-ended polishing spindles with idler backstand equipment for general use.

An outstanding feature of these

Fig. 4—Reciprocating table fitted with balance type head for smaller flat components



machines is that a consistent finish is obtained on the article being polished.

One of the main advantages with these automatic machines is that semi-skilled labour can be used, thus enabling the valued services of skilled polishers to be put to use on difficult and complicated work such as assembled door frames, etc., which do not lend themselves to automatic polishing.

Dust control equipment has been installed by Haddow Eng. Co., and all machines are adequately cowled. Ducting passes to a dust extraction plant made by Modern Industrial Ventilation and Oven Co. Ltd., capable of handling 28,000 ft^3/min.

MULTIPLE GUN UNIT FOR TREATMENT OF SMALL PARTS

Conveyorized Automatic Spraying

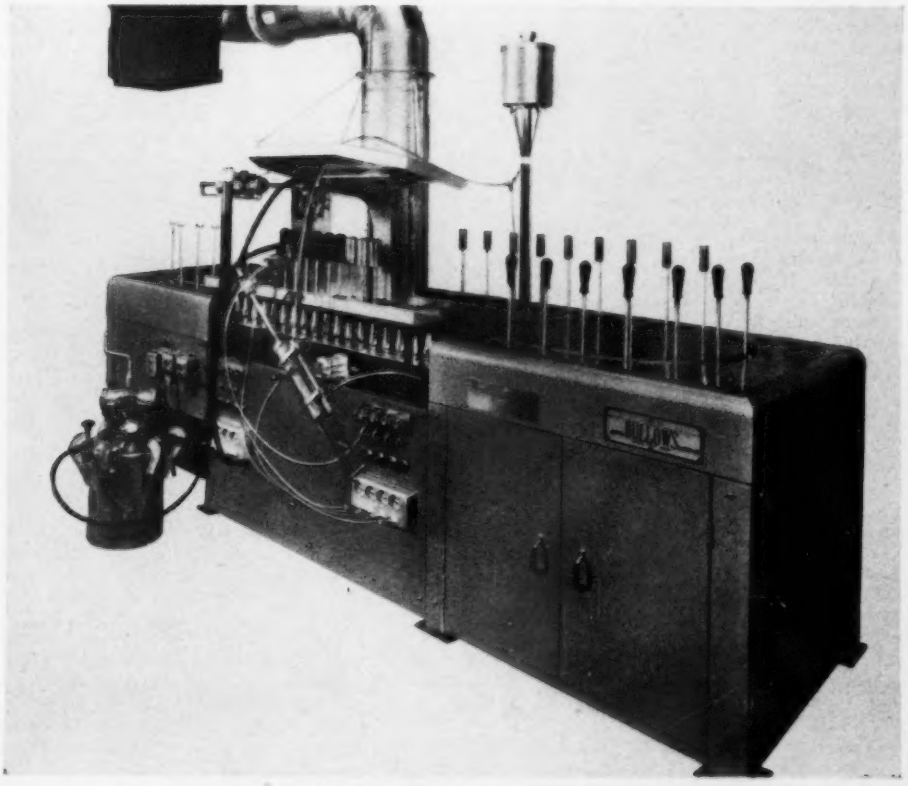
IN many industries, the spray painting of small components calls for special equipment if unnecessary handling is to be avoided, and to meet this need various devices have been designed to make this work more automatic. One of the most recent of these is a conveyorized automatic spraying machine introduced by Alfred Bullows and Sons Ltd., Long Street, Walsall, Staffs. In these machines each basic unit consists of a conveyor track; a spraying station comprising one spray gun, a gun traverse motion and brackets, and a downdraught exhaust system.

Apart from the air required for spraying purposes, power is provided by two electric motors. One drives a gearbox via a 5-speed step cone pulley which, in turn, through a series of shafts and cams, drives the conveyor chain, operates the gun motions and also the automatic spray gun operating valve. The extent of the gun motion is determined by the profile of the appropriate cam, of which a standard range is available. The length of spraying time is infinitely variable by means of adjustable cams. Compressed air at 60 lb/in^2 is required to operate spray guns and valves.

Dependent upon the rate of production required and the type of article to be sprayed, the unit can be fitted with a 2 in., 3 in., 4 in., or 6 in. pitch chain into which workholders fit, and as standard has approximately 25 ft. of chain. This can be extended either when supplied or at a later date if required. Since, of necessity, workholders will vary in size and shape, they are not included in the basic unit and are available as extras. On this machine, the conveyor is in constant motion, and guns, when spraying, follow the work targets. This reduces inertia problems and greatly simplifies the mechanism, entirely eliminating chain make-up devices.

Automatic spray guns are rigidly mounted on the gun cylinder arms, which are hydraulically powered (via gearbox operated master cylinders). When it is necessary to change to articles of varying sizes, adjustment is quickly and easily effected by interchanging or adjusting cam settings to cover gun motion and spraying time. Accurate changes to predetermined spraying angles are made simple by the incorporation of calibrated gun arms and mountings. If, by any chance, the hydraulically operated gun motion is jammed or impeded, a relief valve in the system allows for overloading and no damage is sustained. Furthermore, the hydraulic system re-adjusts itself without disturbing the gun settings.

The downdraught exhaust system is ducted vertically through the centre of the machine, opposite the spraying station. Paint-laden air is carried down to the easily removed castor-mounted



Automatic spraying unit for small and medium components. The example shown is equipped with two guns, one above and one at the side of the work being sprayed

TABLE I—ESTIMATED PRODUCTION RATES

Approx. rate	Article	Characteristics
30 to 60 per min.	Aerosol cans Bottle tops Small balls Bobbins Cans Bell tops	Generally cylindrical components up to 4 in. dia. × 8 in. high
10 to 25 per min.	Switchgear boxes Clock cases Glass-ware Larger play balls (10 in. dia.)	Rectangular components Small pressings
5 to 10 per min.	Television tubes (24 in. dia. × 24 in. high) Car wheels Large cans Brake drums Axle castings Carpet sweeper boxes Car dynamos	

separator, which incorporates an effective system of circular baffles, and the exhaust air is then taken up and out to atmosphere.

Extra gun motions can be fitted, and also an additional spraying station. If required, a water wash exhaust system can also be provided. Centrifugal type exhaust fans, with necessary ducting, paint supply system and workholders, are all available as extras.

A mechanical memory device is available as an optional extra. This automatically signals the machine when workholders are loaded or not, and thus provides a flameproof paint-saving device, also preventing unloaded workholders from being painted.

A machine can be supplied with either 25 ft. of chain or a floor mounted conveyor for transportation to an unloading station, where air drying materials are used, or a stoving oven. Infinitely variable speed drives are also available. Any combination of these alternatives can be built into a standard unit at extra cost. Stoving ovens can be gas or electrically heated to suit customers' requirements.

A test machine at the manufacturer's works is used to paint customers' components to establish how many work stations and gun motions are necessary.

An idea of the rate : size ratio provided by the machine is given in Table I.

All of the components listed in Table I can be sprayed on the standard drive unit machine, which has a driving sprocket diameter of approx. 28 in.

Where a machine is required to spray components over approx. 12 in. dia., a standard type drive unit, but fitted with a 42 in. driving sprocket, would be supplied.

Men and Metals

It is reported that **Sir John Cockcroft** has been awarded the 1961 Atoms for Peace award, given annually as a memorial to Henry and Edsel Ford. Sir John was chosen not only for his skill as a scientist and director of scientific and engineering research, but also for his dedication to the concept of using the power of the atom for the benefit of mankind. He was a Nobel Prize winner in 1951.

News from Murex Welding Processes Limited is that **Mr. R. E. H. Bell** has been appointed home sales manager in place of **Mr. H. Martin,** who retired last month. **Mr. K. Leevers** and **Mr. P. Hobbs** have been appointed assistant home sales managers (technical) and **Mr. S. E. Smith** has been appointed plant sales manager.

Chairman of the United Kingdom Atomic Energy Authority, **Sir Roger Makins,** G.C.B., G.C.M.G., is representing H.M. Government at the formal opening of the Canada India Reactor at Trombay, India, this week, and he is also taking part in a Symposium being held at Trombay at which he and **Sir John Cockcroft** are presenting Papers on aspects of the U.K. nuclear power programme.

Overseas representative for Expandite Limited, **Mr. I. M. Jeffrey** has left London for a tour of North and West Africa.

It is announced by Martonair Limited that **Mr. M. R. Taylor** has been appointed technical representative for East Staffordshire, Derby, Sutton Coldfield, and northern Birmingham.

Changes in their overseas organization have been announced by British Insulated Callender's Cables Limited as follows:—**Mr. C. Murray** to be general overseas manager; **Mr. C. A. Chidwick** to be overseas manager responsible for the Middle East and the Near East; **Mr. G. C. Knight** to be overseas manager responsible for Australia, New Zealand, Canada and the United States, Central America, West Indies and South America, and Spain, Portugal and Gibraltar; **Mr. A. F. Coventry** to be overseas manager responsible for Europe, India, Pakistan and Ceylon; **Mr. J. L. Woollett** to be regional manager for Canada and the U.S.A.; and **Mr. W. F. North,** while continuing as secretary of Telcon and Selborne Plantation Company Limited, and as general manager of Telcon Enterprises Limited, has become personal assistant to Mr. Murray.

Secretary to the Thermal Syndicate Limited, **Mr. John C. Pipkin** has been appointed to the board of that company. He will continue in the position of secretary.

After 50 years' service with the company, **Mr. A. S. Black,** a director of The General Electric Company Limited and area manager for Scotland, has retired. He is succeeded by **Mr. John S. Langlands,** previously assistant area manager for Scotland.

In place of **Mr. N. G. Welch,** who has resigned from the board, **Mr. Graham Firth** has been elected chairman of Metal Mouldings. **Mr. Slater** has been elected a director, and **Miss E. M. Young** a special director.

Appointments to the board of George Kent Limited have been announced as follows:—**Mr. R. G. Kent** to be deputy chairman, and **Mr. W. A. H. May** to be assistant managing director.

It is understood that Smiths Industrial Division have appointed **Mr. Haydn Hollyman** as area representative for the Midlands, to replace the late Mr. P. V. Scholes.

It is reported that **Mr. H. B. Morris** has been appointed to the board of Wickman Limited.

Retiring today as an executive director of Metallisation Limited, **Mr. W. E. Ballard,** F.R.I.C., F.I.M., will still remain on the board of that company, and also on that of Charles Clifford Limited.

Joint managing director of G. A. Harvey and Company (London) Limited, **Mr. D. K. Fraser** has been appointed managing director. **Mr. H. E. Cooper** has relinquished his appointment as joint managing director but remains a member of the board.

Managing director of Guest, Keen and Nettlefolds (South Wales), Ltd., **Mr. N. R. R. Brooke** has been appointed a director of Guest, Keen and Nettlefolds Limited.

HOMOGENEOUS DUCTILE MATERIAL WITH IMPROVED PHYSICAL PROPERTIES

Sintered Reactor Materials

ALUMINIUM plus boron or rare earth oxides — a useful control material for nuclear reactions— is now available in a pure, homogeneous, and easily workable form. Formerly, wide use of such combinations, possessing important nuclear properties, were limited by fabrication difficulties. In alloying, even small amounts of these additives so embrittled aluminium as to render the end product virtually unworkable.

The Sinterwrought process, a powder metallurgy technique, developed by the Sintercast Division of Chromalloy Corporation (Yonkers, New York), is claimed to give a product so dense that its physical properties equal or exceed those of a cast and wrought alloy of the same composition. For example, Binal, boron carbide uniformly dispersed in an aluminium matrix, can be produced in continuous strip form which may be wound into coils and cylinders, or fabricated into countless other shapes. On the other hand, conventional powder metallurgy methods produce materials which may be porous, brittle, and weak.

Because of its affinity for neutrons, boron is widely used for controlling pile reactions. Binal, with up to 5 per cent boron, is most often used as a "burnable poison", to reduce reactivity when starting the nuclear cycle. Compositions containing up to 12 per cent boron carbide (by weight) are used for shielding or controlling pile reactions. For even greater neutron absorption, the isotope boron-10 can be substituted for boron.

Other materials produced by this process, combining rare-earth oxides with aluminium, are used for experimental nuclear work, control rods, shielding, or reflectors. Relatively inexpensive composites containing oxides of such unusual metals as dysprosium, gadolinium, samarium, europium, or holmium are being produced.

Solid State Composites

Sinterwrought products are sintered and worked composites, consisting of a high-melting phase uniformly dispersed in a metal or alloy matrix. The process is applicable to compositions containing up to about 30 per cent (by volume) of dispersoid, usually an oxide, carbide, boride, or intermetallic compound.

Because these composites are produced from elemental metal, alloy, or mixed powders by a solid state process, extremely close tolerances in composition are possible. Compared to the usual alloying technique, which involves melting and casting, there is virtually no loss of constituents due to volatilization or segregation. Accuracy of the final composition, therefore, depends only on the care in weighing out ingredient powders, permitting high precision, and easily reproducible results.

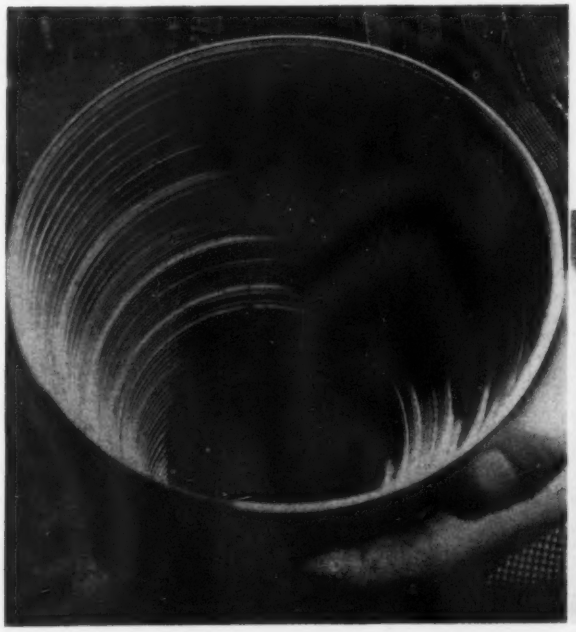
A tolerance of ±0·01 per cent, almost the limit of chemical analysis, may be obtained with a dispersoid content of about 5·0 per cent (volume).

Another advantage is the fact that production by solid state powder metallurgy guarantees purity of composite. Constituents are never molten, so that there can be no absorption of foreign matter from addition agents, atmosphere, or mould materials. Therefore, production of reactor materials with specified neutron capture cross-sections presents no problem.

Of equal interest in nuclear technology is particle size of the neutron-absorbing constituent. Capture of free neutrons and consequent regulation of the pile, is affected by the spacing, or mean free path, of the dispersoid phase.

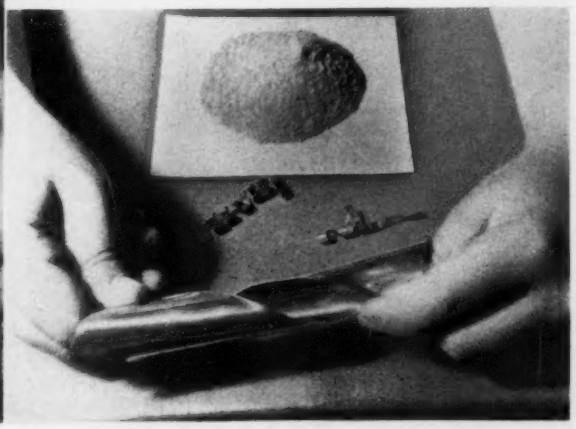
The powder metallurgy techniques employed in the Sinterwrought process permit easier regulation of particle size and closer control over microstructure than are possible by conventional melting and casting.

Ordinary melting procedures also fail when two or more constituents in a desired composition are mutually insoluble. Even if the dispersoid phase is totally or partially soluble, conventional alloying may cause embrittlement, resulting in a product which is difficult to fabricate into usable shapes. Powder metallurgy, however, extends the range of materials, permitting the use of almost any ingredient, whether or not fusible, soluble in the matrix metal, or unstable at fusion temperatures. Alloy compatibility is no longer



Left : Flexible enough to be wound into a coil, Binal sintered and wrought material, consists of boron uniformly dispersed in an aluminium matrix

Below : Even when subject to severe twisting a strip of Binal does not fracture



a problem, allowing the nuclear designer to choose constituents according to his needs.

The composites offer an additional advantage in being unusually homogeneous. Special blending techniques ensure thorough mixing of ingredients, even if they differ greatly in density. Once uniformly mixed, the dispersion is unaffected through all subsequent operations of sintering and working. A nuclear test on a Binal strip, about 200 ft. long, showed a variation of only 0·003 per cent in boron content from one end to the other.

The first step in the process is careful weighing of the constituents, to ensure the exact composition desired in the final product, and thorough mixing in special mills. Measured portions of the mixed powders are then formed into "green" compacts or billets, using hydrostatic or other modern presses.

Next, the compacts are sintered at a temperature below the melting point of any constituent. During this time, a diffusion process bonds the metal particles to form a solid, though porous composite. To achieve full density, the compacts are hot-worked a few times. After all residual porosity has been eliminated, the material is very ductile, and possesses excellent physical properties. For example, Binal with a boron content of 0·1 to 0·4 per cent has a tensile strength of 20,000 to 30,000 lb/in^2, depending on the degree of cold-working it has undergone. Under intense radiation, it will even gain slightly in strength, but decreases somewhat in ductility.

Final fabrication involves cold-rolling, sizing, slitting or machining, to form the end product. Binal is usually supplied as foil, up to $\frac{1}{4}$ in. thick by 5 ft. wide, and 10 to 12 ft. long. All the composites can be ordered in many different shapes; tubes, strip, foil, or plates are readily fabricated. A typical custom product is a bushing made from gadolinium oxide and type 2A aluminium, $\frac{1}{2}$ in. diameter by $\frac{5}{8}$ in. long, with a wall 0·041 in. thick.

The powder metallurgy techniques are equally applicable to matrix metals other than aluminium. For example, stainless steel is preferred to aluminium for many nuclear applications because of its superior high-temperature properties, and resistance to oxidation in pressurized water reactors. Stainless steel has not been widely used as a matrix metal because of its susceptibility to embrittlement by boron, but the Sinterwrought solid state process greatly reduces this tendency. In addition, powder metallurgy permits control over microstructure, such as selection of optimum particle size and spacing, to decrease danger of embrittlement after radiation. Rare earths can also be dispersed in stainless steel to form a whole series of new reactor materials with unique properties and possibilities.

Oxidation Prevention During Forming

A METHOD of precoating metals used in aircraft production to prevent oxidation and material loss during thermal-treatment has been developed by the Aeronautics Division of Chance Vought, Dallas, Texas. Patent applications are pending on the process, in which copper or aluminium is sprayed on a metal before treatment. The copper or aluminium produces an oxide coat which protects the metal part from damage during hot forming, stress relieving, heat-treating or annealing. The precoat forms a lubricant for subsequent forming, stops oxidation of the metal and is easily removed.

Many close-tolerance parts were previously rejected because of metal loss from 0·002 to 0·012 in. during stress relieving. With application of the new precoat, loss of material is maintained between 0·0001 and 0·005 in.

In addition to various ferric materials and ferrous alloys which may be protected by the coating, the process is valuable in protecting metals like beryllium, niobium, molybdenum, rhenium, tantalum, tungsten, vanadium and zirconium, as well as nickel alloys.

The spray coating is applicable to any metal with which aluminium or copper is non-alloyable. The solution, as an example, may comprise aluminium pigment paste powder or flake dissolved in lacquer and lacquer thinner, or the coat may be aluminium or copper oxide sprayed on. During the thermal treatment, the original aluminium or copper is decomposed into an oxide and the organic binder is burned out.

The maximum temperature to which metal parts may be thermal-treated is controlled by the melting temperature of the coating material. In the case of aluminium oxide precoat this is 2,050°C. and 1,235°C. for copper oxide.

In subsequent experience with the process, the company found that the aluminium metal spray was successful in protecting steel and stainless steel brazing retort envelopes and boxes from oxidation at elevated temperatures up to 1,100°C. Previously, the retorts had to be cleaned of heat scale by sand blasting and vapour honing after each brazing cycle. The aluminium spray changes to oxide, providing such a good coating that retorts can be made of cheaper material than stainless. As the aluminium oxide coating wears to the basic metal, it can be removed by a sodium hydroxide method for a reapplication of the aluminium spray, protecting the retort indefinitely from oxidation or scaling.

Before developing its spray method of protecting metals, it was found that processes for stress relieving or pickling were inadequate for mass production of thin parts, such as titanium, which must be maintained at a precise thickness. Hydrogen embrittlement, also, was introduced during the nitric-hydrofluoric pickling bath.

Applying an aluminium precoat to a titanium shroud stiffener for a Vought F8U-2N fighter aircraft

Passivation of Copper

SURFACE films which greatly enhance resistance to corrosion and discoloration by salt droplets, perspiration and indoor atmospheric pollution can be produced on copper and its alloys, particularly the brasses, by the use of certain additives to a sodium-dichromate-sulphuric acid bath. In the process which, according to *N.R.D.C. Bulletin*, is the subject of a patent application, the film causes a change in surface appearance, and such films, the thicknesses of which can be controlled by other additions to the bath liquor, may assist the better adherence of transparent lacquers to ornamental brass goods. The articles to be treated are dipped in the bath liquor for 5-10 sec.

New Plant & Equipment

Plate Shearing

SUITABLE for high speed production methods, a range of precision guillotine shearing machines, known as Series 25, has been introduced by Rushworth and Co. (Sowerby Bridge) Ltd., Sowerby Bridge, Yorkshire.

The machine produces a very clean sheared edge by virtue of the fact that the slide moves downwards and backwards simultaneously on the downward stroke, as the slideways have a 2° forward slope. The blades, which are of the finest quality alloy steel, have four cutting edges. The bottom blade is mounted on a blade block, which is adjustable over its full length to permit accurate setting of the blade clearance.

An electric motor with high slip characteristics is mounted co-axially with the worm shaft and flywheel, and the drive is transmitted through a multi-jaw dog type clutch released by a solenoid-operated plunger controlled by a foot switch at the end of a flexible armoured cable, a feature which is particularly useful when dealing with large plates. Alternative controls, such as push buttons, mounted on the machine or on a pendant, can be fitted if preferred.

The standard hold down is of the plunger type, mechanically operated, each plunger being individually spring loaded. A hydraulic system with plungers operated from a master cylinder can be supplied as an alternative.

Two support arms are fitted to the front of the table and a squaring arm, with two swing stops in a length to suit the particular application, can be provided. A precision back gauge with direct reading dial indicators can be fitted in place of the standard back gauge.

A waste chute of a length suitable for the operating requirements is fitted to push cut-off blanks away from the machine.

The Rushworth Series 25 precision guillotines are supplied in models with a mild steel capacity ranging from 6 ft × ¼ in. to 12 ft × ¼ in. Speed of operation is 60 strokes/min.

Level Control

A COMPACT conductivity operated liquid level controller, known as the "Resistron", has been introduced by Thomas Industrial Automation Limited, of Altrincham. The equipment does not involve any moving parts in or on the containers, and a full range of electrodes is available in two forms.

This instrument is available as a fixed sensitivity instrument high or low level, or fitted with a continuously variable sensitivity control and high/low change-over switch.

The "Resistron" is intended for use with any conducting liquid, provided the specific resistance does not exceed 50,000 ohms/c.c. It is ideal for the control of various types of acid and controlling the level of water in feed tanks, etc. In conjunction with a high temperature electrode it can be used for boiler level control and will give audible and visual alarm as well as taking corrective action when the water in an unattended boiler has fallen to a dangerous level.

Two electrodes can be used with one controller to give high and low level alarm or control facilities. A special range of electrodes is available for all types of industrial application.

Thread Whirling

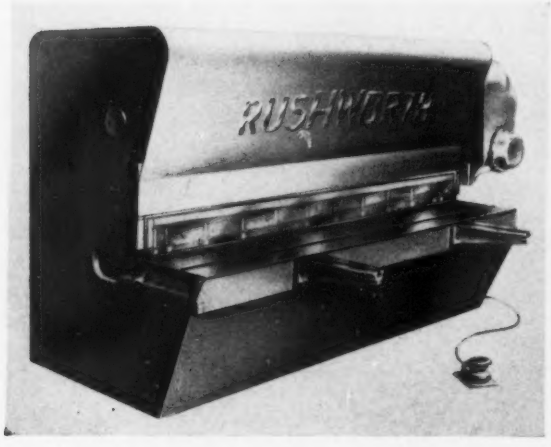
DESIGNED for use in small production runs, and easily operated by unskilled labour, the Jaggi type MF 57 thread whirling machine enables precision internal and external left- and right-handed threads to be cut by means of tungsten carbide tools whirling round the workpiece.

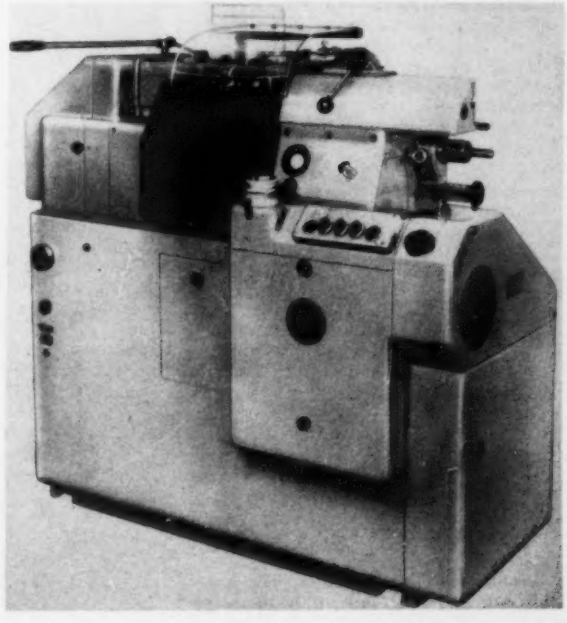
The work is clamped in chucks or spring collets, and may be supported by a tailstock rest. The screw-cutting operation is synchronized with the rotation of the work-spindle and the longitudinal movement of the cutter head, the latter being controlled by a lead-screw and a set of gears, both interchangeable. The pitch of the lead-screw being larger than the required profile, different threads may be obtained with the same lead-screw. Non-productive movements are generated by two cams, which may be used for a large number of different components.

Various speeds of the cutter head are obtainable using a set of interchange-

Right—The Jaggi type M.F.57 thread whirling machine

Below—Rushworth Series 25 precision guillotine shearing machine





Large welding positioner, D.B. 10,000, marketed by Interlas Ltd.

able pulleys, while an electronically controlled driving gear permits stepless variation of the speed of revolution of the workpiece.

The four tungsten carbide tools may be set longitudinally and vertically by means of an optical device. Three sizes of adjustable standard toolholders are supplied for externally threading components from 0·8 to 2·4 in. in diameter. For diameters greater than 2·4 in., non-adjustable toolholders adapted to the workpiece should be used.

Threading may be started without any previous recessing. Moreover, it is possible to start the thread at any given point of the workpiece, since the work spindle always stops at the same place. Multi-pitch threads—with 2, 3, 4, 5, 6, 10 or 12 starts, may be cut by altering, manually or automatically, the angular position of the work spindle at the end of a thread.

In addition to standard accessories, a variety of special accessories is obtainable, including an automatic feeding attachment, automatic dividing attachment for multi-pitch threads, cams for left-hand threads, and special cams for accelerated non-productive movements (thread-cutting with recessing).

Sole agents in the United Kingdom for the Swiss manufacturers (Charles Jaggi Machine Tools) are Vaughan Associates Ltd., 4 Queen Street, Curzon Street, London, W.1.

Welding

A RANGE of variable speed welding positioners was introduced to this country recently by Interlas Limited, of Ampthill, Bedford. These machines are made by Tehrg of Germany, and ten models cater for maximum loads of 33 lb. up to 10 tons.

The bench model DB 15 has a capacity of 33 lb. and and infinitely variable speed range of 0·3 to 3 r.p.m. with a foot-operated remote control for "stop" and "start", so that the operator has both hands free for welding.

A 12 in. diameter slotted top plate has a built-in earthing attachment, and can be tilted and locked throughout 360° of movement. A switch for "forward" and "reverse" motions is provided on the front of the machine, along with screw-out fuses.

At the other end of the range, the 10 ton model DB 10,000 has a speed range of 0·06 r.p.m. to 1·2 r.p.m., a 5 ft. square top plate tilting at 0·5 r.p.m. through heavy duty twin tilting segment gears, and a 750 amp. earthing attachment. Remote controls, foot-operated, can be provided for "stop" and "start" motions of rotation and tilting, or, alternatively, push-button remote controls for "forward", "stop", "reverse", "fast—slow" for rotation and "up" and "down" for tilting.

Between these models come positioners for maximum loads of 2 cwt., 5 cwt., 1 ton, 1½ tons, 2½ tons, 3½ tons, and 6 tons.

Complete jigs for the automatic welding of small cylinders are also obtainable, consisting of rotating equipment and supports for the welding head, with all necessary electronic controls.

Improved Niobium Alloys

A GROUP of niobium alloys containing tungsten and titanium has been developed by Union Carbide International Company in an effort to improve the strength and oxidation resistance of niobium.

Several of the alloys developed in the studies reported have been produced in experimental quantities. These include Cb 7 (65 Nb-7 Ti-28 W), Cb 84 (70 Nb-7 Ti-20 W-3 Mo) and Cb 16 (65 Nb-10 Ti-20 W-3 V). Alloys with a low thermal neutron capture cross section include Cb 22 (94 Nb-3 Al-3 V) and Cb 24 (87 Nb-7 Ti-3 Al-3 V).

Maximum oxidation resistance in niobium-tungsten-titanium alloys was obtained through a compositional range of 5 to 15 per cent titanium by weight and in excess of 15 per cent tungsten by weight. Although the oxidation rate of these alloys is reduced one-hundredfold in comparison with pure niobium at temperatures above 1,204° C., they are sensitive to oxygen contamination. The oxidation resistance is sufficient, however, to allow short-time service in air at high temperatures provided that structural ductility after service is not important.

The alloys were found to be fabricable and to have ultimate tensile strengths in excess of 40,000 lb/in² at 1,204° C. The effects of additions of other elements such as vanadium, molybdenum, chromium and zirconium were also investigated.

Zirconium was found to improve high-temperature strength but reduce oxidation resistance. Molybdenum and vanadium markedly reduced surface oxygen embrittlement but also limited the temperature range in which the alloys resisted oxidation.

With regard to the niobium-aluminium-vanadium alloys, it was found that the addition of small amounts of aluminium and vanadium to niobium improved the oxidation resistance by stabilizing a protective layer of niobium oxide. As little as 3 per cent each of the two elements produced a fifty to hundredfold improvement over the oxidation resistance of pure niobium in the temperature range of 816°-1,204° C. Additions of titanium gave further improvement in oxidation resistance but lowered the strength, while zirconium additions had the opposite effect. Titanium additions had an adverse effect on stress rupture properties. The niobium-aluminium-vanadium alloys had good resistance to oxygen contamination of the surface metal.

Investigational Techniques

(*Continued from page* 44)

cases of fatigue failure in aircraft structures there is some evidence of fretting. Fretting product in many cases is visible on the fracture surface and it may well be that this affects the early stages of crack propagation. A fretting fatigue failure in a lug that was part of a pin joint assembly fatigue tested in push pull is shown in Fig. 20. The fretting on the face of the specimen was caused by the side plates. Fretting has transferred the point of failure from the thinnest section across the hole to a much larger section. Fretting usually produces a multiplicity of cracks, only one of which propagates. The crack that does propagate is usually at the edge of the fretted patch.

References

[3] C. A. Stubbington; Unpublished M.O.S. Report, May, 1958.

(To be concluded)

Industrial News *Home and Overseas*

New Plant for Nickel Brighteners

For the production of raw materials for six of their nickel brighteners, **Electro-Chemical Engineering Company Ltd.** have built at their Woking factory a completely new manufacturing plant. The majority of the plant is used for the manufacture of the constituents of brighteners used in the bright nickel process. The equipment in this plant consists of a number of stainless steel steam jacketed reaction vessels, rubber-lined purification tanks and rubber-lined intermediate and bulk storage tanks: the inter-connecting pipework is also rubber lined. The brighteners are manufactured in batches from readily available raw materials in the stainless steel reaction vessels which are fitted with glass condensers for reflux distillation operations. On completion of the reaction, the crude products pass into the rubber-lined purification tanks, where they are treated, purified and then filtered to the intermediate storage tanks.

The brighteners are then held in the intermediate storage tanks until they have been approved by laboratory analysis and plating tests, after which they are pumped to 8,000 gal. bulk storage tanks. When required, they are then pumped to further storage tanks, from where they are dispensed into containers for despatch to customers. The use of stainless steel and rubber-lined equipment in the various process stages has been found essential in order to maintain product purity and to resist corrosion of the equipment.

The building, attached to the main factory, is constructed of brick and has acid-resistant flooring, while the internal walls are glazed to a height of 8 ft. A comprehensive fume extraction system has been installed and removes noxious fumes from the tops of all condensers, vessel openings and purification tanks. As inflammable raw materials are used, all the electrical equipment and fittings are of a flameproof type.

An Acquisition

Through its subsidiary, Firland Metals Ltd., the **Firth Cleveland Group** has acquired Quirk, Barton and Burns (St. Helens) Ltd., makers of sheet lead, lead pipe, solder, laminated lead, and other products. Primarily, the acquisition was made to reinforce R. E. Roberts and Son Ltd., another company in the lead division of the group.

This acquisition means that the group will have three lead and lead alloy production centres strategically placed throughout the country, and thus will provide service adequate to meet the increasing demand that is being experienced from the building, chemical, atomic and other industries.

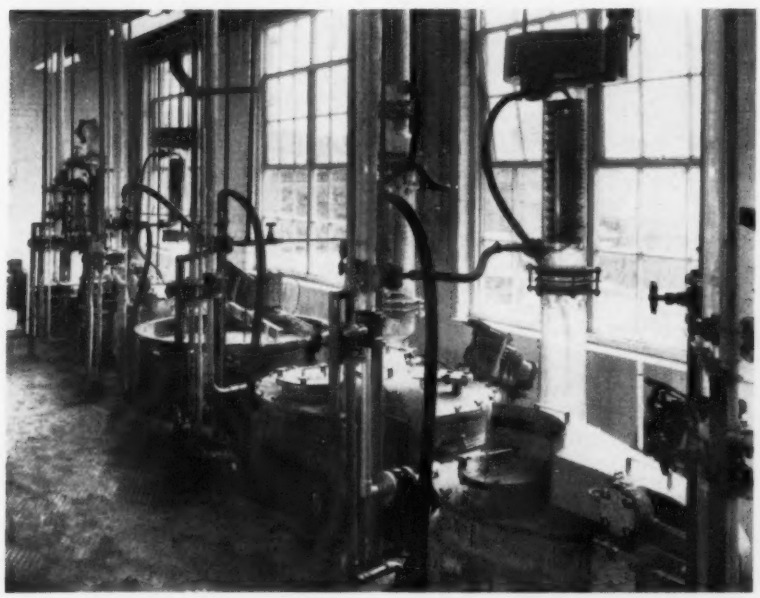
Metals Market for Buenos Aires

According to news from Buenos Aires, a non-ferrous metals futures market is to start operations there immediately. This is believed to be the third market of its type in the world, and its sponsors hope it will, in time, give considerable stimulus to mining.

During the formal inauguration of the bourse, the President of the board, Senor Angel Pisano, said that the Argentine mining industry would enjoy greater credit facilities and would, therefore, be greatly encouraged; that operations closed on the market would be registered under the responsibility of brokers and interested firms, and that operations concluded during the bourse's trading hours would have the binding obligation of formal contracts.

The market is requesting that contracts arrived at during trading hours and entered in the market books be exempted from the stamp tax. The market is starting as a joint stock company with a capital of 1,000,000 pesos. At the outset only residual stocks are likely to be offered for sale, but it is hoped that the market will, in time, become a standard centre of operations.

Stainless steel reaction vessels and glass condensers at the Woking factory of Electro-Chemical Engineering Company Ltd.



Australian Mineral Outlook

A noted mining authority and deputy chairman of Consolidated Zinc Pty. Limited, Mr. M. A. Mawby, has said that recent developments in the Australian mining industry indicated that more mineral, oil and natural gas discoveries would be made soon.

Australia's future progress would be accelerated by the establishment of some giant mining operations in the most remote areas of the continent. Development of the huge bauxite deposits in the Cape York Peninsula would begin next year. Australia's total reserves of bauxite were greater than any other continent in the world, Mr. Mawby said. The relaxation of the export ban on iron ore would increase the search for more deposits.

Bauxite in Sierra Leone

Bauxite mining is likely to begin in the south-western province of Sierra Leone next year, according to an official announcement. The discovery of ore was made last year by the Geological Surveys Department and, after further investigation, the Swiss Aluminium Company, of Zurich, took out a prospecting licence. Some 250 drill holes were sunk in the Mokanji Hills area. They show that bauxite occurs in a narrow band over a length of 18 miles. Samples have been collected and shipped to Germany for washing trials to determine the most suitable washing plant to be installed in Sierra Leone to produce high-grade ore.

An Industrial Tool

Under this heading in our issue of January 6 (p. 14) we referred to a new industrial tool which has been introduced by **Firth Cleveland Tools Ltd.** We are asked by that company to state that this tool will not be available until the middle of February.

Aluminium Cable Sheathing Presses

During the past few months, **Schloemann Aktiengesellschaft,** Düsseldorf, have received from Japanese cable producers orders for four of their fully-automatic aluminium cable sheathing presses. This brings up to 21 the total number of these presses either supplied or in the course of construction.

Cables of any desired length can be sheathed on these presses. Through the automatic die adjuster, the thickness of the cable sheath is maintained constant, even when there are intervals in the extrusion process, either for loading a fresh supply of billets or in the event of troubles. Cable cores served with temperature-sensitive insulating material, such as polyethylene or styroflex, can be sheathed in unlimited lengths, which is

made possible by a dependable heat-protective arrangement for insulated cores.

Production Agreement

An announcement has been made by **Tube Investments Ltd.** that they have concluded an agreement with Techne (Cambridge) Ltd. for rights to manufacture a micro-tensile testing machine developed by the Tube Investments Research Laboratories, near Cambridge. The machine now deals with single crystal "whiskers" often too small to resolve with the naked eye.

It employs a torsion balance to apply loads of 1 mg. to 400 gm. to specimens with cross-sectional areas down to one 5,000 millionth/in^2, and it measures by optical and mechanical means extensions in the specimen to a few Angstrom units to 15 mm. It can readily be adapted for tests in compression, tests in special atmospheres, and for thin film testing.

The Leipzig Fair

More than 200 British firms will be showing their goods at this year's Leipzig Spring Fair, many of them for the first time, compared with 1960, and floor space for the British exhibitors has nearly doubled. The Fair opens on March 4 next and lasts for 10 days.

Aluminium Passenger Stairs

An improved form of passenger boarding stair for use with their aircraft at London and other airports is now being used by Pan American World Airways. This is the Edghill "Autostair", a tubular structure enclosed in aluminium sheet and mounted on a Karrier commercial vehicle chassis. The unit is self-propelled and speeds up the loading and unloading of passengers from an aircraft.

The stair treads are of Noral aluminium alloy treadplate, supplied by **Alcan Industries Limited,** who also supplied the Noral aluminium sheet which encloses the unit. The treadplate, which has a raised lozenge pattern and is extremely durable, provides a good foothold under all conditions and also assists in reducing the weight of the structure. It is understood that Pan American have eighteen of these units in service at various airports throughout the world.

Lightweight Cutting Blowpipe

As from February 1 next, the "Firefly", **British Oxygen's** new ultra-lightweight hand cutting blowpipe, becomes generally available. This unit weighs only 12 oz. and can cut mild steel up to ¾ in. thick. Initially, nozzles will be available for use with acetylene, but the early introduction of a range of propane nozzles is also planned. The blowpipe and its accessories are supplied in a plastics carrying case.

Bills of Lading

Uniformity in bills of lading has been under discussion by the British Liner Committee and the British Shippers' Council. The possibility of having a bill of lading form of standard size and layout long advocated in many quarters has been brought a stage nearer following on further discussions now taking place between the British Liner Committee and the British Shippers' Council. The Shippers' Council's proposals have been embodied in draft forms using the International A4 size, lengthened so as to meet the requirement of some shippers for more space for cargo details. The sizes under consideration have been:

International A3—approximately 11¾ in. × 16½ in.; International A4—approximately 8¼ in × 11¾ in.; B.S.C. A4—approximately 8¼ in × 16½ in.

The first draft of a proposed form has already been widely circulated to members of the British Shippers' Council, as a result of which a number of modifications were made. The International standard sizes have been used as a basis for discussion because these sizes are becoming more and more widely used internationally, particularly in the Scandinavian countries. There can be no doubt of the advantages to exporters in having a standard size and layout of bill of lading and, of course, other export documents, and shipowners are also aware of the benefits to be derived from a wider use of standardization and mechanization in the production of their own documents.

Instrumentation

A one-day Conference has been arranged by the Society of Instrument Technology and The Birmingham Productivity Association, to be held at the College of Technology, Birmingham, on Wednesday, March 29 next. The Conference is aimed at the small to medium sized manufacturer, and the object is to show the various aspects of instrumentation which will increase productivity profitably.

The lectures at the Conference will stress (a) increased productivity using the same labour force; (b) consistent quality of products by controlled measurement; (c) reduction of scrap, during processing, by in-line inspection, including non-destructive testing.

To introduce the managements of the manufacturers to instruments, an exhibition has been arranged with the Conference, at which instruments which are discussed during the day are exhibited. Potential users will be able to discuss their ideas with instrument experts.

World Tin Position

World mine production of tin-in-concentrates was estimated, by the International Tin Council's Statistical Bulletin for December to have fallen slightly in October to 13,500 tons, compared with 13,800 tons in September. On the assumption that output continued at approximately this level in November and December, world production for 1960 could provisionally be put at 158,500 tons as against 141,000 tons in 1959. (These estimates excluded Soviet production, but included Chinese output, reckoned at 24,000 tons.)

World smelter production of tin metal, including estimated production in the United States, fell from 14,800 tons in September to 13,500 tons in October. On the basis of the available figures it seemed, according to the Bulletin, likely that 1960 world output, exclusive of Russian production, exceeded world mine production by over 10,000 tons, reflecting the marked drawing down of stocks.

World consumption of primary tin metal was estimated to have remained virtually unchanged during September at 15,500 tons. Provisional stocks of tin in the Congo amounted to 1,450 tons at the end of September.

At the end of October, stocks of tin-in-concentrates in the Federation of Malaya and Singapore were 7,683 tons, as against 7,401 tons a month earlier; the Federation of Nigeria 594 tons, compared with 231 tons; and Thailand 772 tons, compared with 585 tons. Stocks at smelters in Belgium and the United Kingdom were higher in October, but by the end of November, U.K. smelter stock figures had fallen back to 1,542 tons as against 1,761 tons a month previous.

Stocks of tin metal in the Congo had virtually been eliminated by the end of September. Stocks of metal in the Federation of Malaya and Singapore showed a small decline at the end of October to 4,968 tons as against 5,083 tons a month previous.

A Conversazione

Members and friends of the Corrosion Group of the **Society of Chemical Industry** are invited to participate in the Conversazione which the group is holding on Thursday next (January 26), at 14 Belgrave Square, London, S.W.1, from 6.30 p.m.

During the evening a buffet supper will be served and a bar will be available. The charge for a single ticket is 10s. and for a double ticket 17s. 6d. There will also be an exhibition arranged by a number of firms and research organizations, the emphasis being on new developments.

Honours Obtained

In the Blown Fused Silica Ware Section of the Physical Society 1961 Craftsmanship Competition entries submitted by employees of the Thermal Syndicate Limited gained 1st, 2nd and 3rd prizes and an honourable mention. The entries have been on show at the Physical Society Exhibition in London this week, and the prize-winning entries in the Science Museum for a further three weeks.

Light Metals

Early notice is given of the 4th International Light Metals Conference, which is to be held at Leoben from June 20 to 24 this year. The conference has been organized by The Montanistische Hochschule, Leoben, in conjunction with the Australian light metal industry. The theme of the conference will be "Light Metals in Light Construction in Architecture and in Special Fields".

Interesting features of this conference are the Papers being contributed by Mr. R. M. Davies, the structural engineer to the Aluminium Development Association; and by Mr. R. J. Durham (Banbury) on "Mechanical Properties of Aluminium Alloys for the Transport of Liquid Gas at Low Temperatures"; and Mr. H. Shaw (Birmingham) on "Special Applications of Titanium and Titanium Alloys".

All enquiries concerning full details of this conference should be addressed to: Geschaftsstelle der 4, Internationalen Leichtmetalltagung, Leoben/Stmk, Montanistische Hochschule, Osterreich.

Italian Liberalization

Under an order issued by the Italian Ministry of Foreign Trade, imports of 120 products from Japan have been liberalized. The list of items whose importation into Italy is no longer subject to special Government licence includes lead and nickel manufactured products.

A London Meeting

Members of the London branch of the **Institute of British Foundrymen** are reminded of the meeting to take place on Wednesday next, January 25, when Mr. F. Hudson will present a Paper entitled "Developments in the Production of Gunmetal Castings".

The meeting will be held at the Constitutional Club, Northumberland Avenue,

London, W.C.2, and will commence at 7.30 p.m.

Trade with Europe

Fact-finding missions, composed of leading businessmen and industrialists drawn from the 30 members of the Export Council for Europe, are to be sent to Europe to confer and work in close co-operation with the commercial representatives of the British Government, British trading interests, existing importers of British goods and all other appropriate bodies. This step was agreed at the second meeting of the Council, last week, under the chairmanship of Sir William McFadzean.

Nine teams of three men will leave during February to visit Britain's six partners in the European Free Trade Association (Austria, Denmark, Norway, Portugal, Sweden, Switzerland) and also France, Italy and Spain. The remaining ten countries covered by the Council will be visited by similar sized missions in May and June. Discussions on the spot will be on the basis of a questionnaire covering market needs; competition from other countries; questions of price, quality and design; and study of successful British export efforts as well as investigation of complaints where these are well founded. The advisability of inviting buying missions to visit the United Kingdom will be explored.

The findings of these teams will be collated immediately and used to guide the Council in its future programme of work. Certain other steps were agreed to promote interest in Western European markets at home, and it was also decided to hold a national convention in the autumn of this year.

An Acquisition

To enable its machine tool division to expand and also speed up production of Lester injection moulding machines, which they manufacture under licence in this country, **J. Brockhouse and Company Ltd.** has announced that it has acquired the Denton, Lancashire, machine tool works of Craven Bros. (Manchester) Ltd., together with all machinery and equipment. Sufficient capacity is also available at this factory for extension of the Lester range, which will include the production of die-casting machines and other interests in plastics now under consideration.

The division has already commenced manufacture of the 6/9 oz. injection moulding machine at its works at Wolverhampton, and the additional capacity will enable the company to implement its policy of building machines in large batches in order to speed up deliveries.

Profile Cutting Machine

An outstanding success at the recent Royal Smithfield Show and Agricultural Machinery Exhibition in London was the "S.I.F. Combi" dual-purpose profile cutting machine marketed by **Suffolk Iron Foundry (1920) Ltd.** and shown on the Qualcast group's stand.

This machine can be used as a magnetic profile cutting unit whereby continuous production can be carried out with great accuracy by means of a steel template. In addition, the cutting motor head can easily be detached from the frame for use as a separate unit to cut straight lines and circles.

Calor, propane or acetylene may be used as the fuel gas in conjunction with oxygen. To cover the range of different cutting speeds needed for varying metal thicknesses, a five-stage switch is incorporated to control the number of revolutions per minute. The machine is also fully adjustable for height of cut according to the thickness of plate being cut.

Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week rose 277 tons to 9,987 tons, comprising London 4,269, Liverpool 3,853, and Hull 1,865 tons.

Copper stocks rose 786 tons to 14,945, distributed as follows: London 1,050, Liverpool 11,120, Birmingham 400, Manchester 2,300, and Hull 75 tons.

Metal Factory for Eire

A factory for the manufacture of non-ferrous tubes, ranging from those used in ballpoint pens to large tubes for industrial purposes, is to be established at Skibbereen, County Cork, by the Standard Metallwerke G.m.b.H. of Werl, Westphalia.

Mr. M. R. Boland, an official of the West Cork Development Association, said the German firm operated a similar plant in Werl. A site of 160 acres had been obtained in Skibbereen for the proposed plant. It will cost about £500,000 to build and equip, but it is understood that the Eire Government has already sanctioned a grant of £200,000 towards the cost under the scheme for under-developed areas. The output of the factory will be exported.

Uranium Find in Australia

It has been reported by Senator William Spooner, Minister for National Development, that a new high-grade uranium ore body had been discovered at Rum Jungle in the Northern Territory. He said it had been established that the body had reserves of ore at least comparable with the total ore bodies which have been mined to date from deposits at Rum Jungle. The Atomic Energy Commission has not released the actual figures for Rum Jungle's first two open cuts, but it is known that millions of tons of ore were lifted and returns are reported to have been very rich.

Aluminium in Spain

Spanish production of aluminium in 1960 is estimated at 29,500 tons, according to preliminary figures published by the Banco Central, compared to 22,642 tons in 1959 and 16,148 tons in 1958. The Bank said that when the two new plants of La Coruna and Vigo are at full production, Spanish capacity will reach 60,000 tons. The Bank commented that Spain, which had imported from 20,000 to 30,000 tons of aluminium in previous years, exported about 20,000 tons to Britain last year.

Malayan Tin Shipments

Tin shipments from Penang in the first half of this month, according to the Straits Trading Company, amounted to 3,695¼ tons, comprising to the United Kingdom 125 tons; U.K. options 50; the United States 637; the Continent 1,902; Canada 15; Japan 629¼; the Pacific ¼; India 128; South America 137½; Australasia 50; and the Middle East 21.

Shipments from Singapore in the same period were 5¾ tons, comprising to the Pacific ¼; and the Middle East 5. Total shipments in December were 7,739½ tons from Penang and 4½ tons from Singapore.

A Birmingham Event

Among the exhibitors at this year's Conversazione organized by the Birmingham and Midland Institute last week, were **The Mond Nickel Co. Ltd.**, whose exhibit demonstrated the development of alloys having a constant modulus of elasticity, particularly useful in watch and clock springs and in weighing machines; **Guest, Keen and Nettlefolds** Group Research Laboratory, who staged an exhibition showing the application to industrial research of the high-speed ciné camera taking up to 5,000 frames/sec. **Bulpitt and Sons Ltd.** had displays illustrating the production of aluminium from bauxite, and the subsequent processing to the final stage of the domestic teapot. **Geo. Salter and Co. Ltd.** exhibited a historical collection of spring balances, and showed something of the part played in industry by the Spring Division of the company.

A number of electrical control systems with applications in many industries were demonstrated by **The General Electric Co. Ltd.**, and a series of electric vibratory feeders were exhibited by **Power Utilities Limited.**

Japan Buys Copper Shares

From Melbourne, Australia, it is announced that the acquisition of 400,000 shares, at a paid-up value of 8s. each, in the Ravensthorpe Copper Mines N.L. by the Mitsui Mining and Smelting Company of Japan will mean that £160,000 is immediately available for development, while the sale of the whole of the company's production to the Mitsui Company for the next 10 years is also included in the agreement, announced last week by Mr. M. R. Lodge, chairman of Ravensthorpe Copper Mines N.L. Mr. Lodge said the purchase terms were subject to review from time to time and would be designed to ensure that Ravensthorpe Copper Mines received world parity prices at all times. This additional capital would enable further development of the Ravensthorpe field.

Forthcoming Meetings

January 24—Institute of Metal Finishing. South-West Branch. Royal Hotel, Cardiff. "Metal Degreasing and Trisec Drying." 7.30 p.m.

January 25—Institute of British Foundrymen. London Branch. Constitutional Club, Northumberland Ave., London, W.C.2. "Developments in the Production of Gunmetal Castings." F. Hudson. 7.30 p.m.

January 25—Society of Instrument Technology. South Wales Section. College of Advanced Technology, Cardiff. "Fire and Explosion Hazard of Intrinsically Safe Instrumentation." S. J. Emerson. 6.45 p.m.

January 25 — Manchester Metallurgical Society. Manchester Literary and Philosophical Society, George Street, Manchester. "The X-ray Microanalyser as a Research Tool for the Metallurgist." Dr. D. A. Melford. 6.30 p.m.

January 26 — Southampton Metallurgical Society. Southampton University. "Hot Dip Galvanizing." M. H. Davis. 7.15 p.m.

January 26—West of England Metallurgical Society. College of Technology, Ashley Down, Bristol. "Recent Developments in Metallography." Prof. R. W. K. Honeycombe. 7.30 p.m.

January 27—Institute of Metal Finishing. Sheffield and North-East Branch. Grand Hotel, Sheffield. "Electroplating Processes; Effect on Fatigue and on Embrittlement of the Substrate." C. Williams. 7 p.m.

Metal Market News

ADVANCE figures issued by the British Bureau of Non-Ferrous Metal Statistics for the month of November were encouraging and suggest a good finish to 1960. Consumption of copper, refined and secondary, in the U.K. during November was 68,168 tons, or nearly 6,000 tons better than October. Of this total, nearly 15,000 tons comprised scrap. Stocks were slightly lower, the November total at 115,305 tons comparing with 118,033 tons at the end of October. Usage of zinc amounted to 32,598 tons, just 2,000 tons more than October, while in lead the consumption during November, at 33,541 tons, was 861 tons higher than in October. The usage of tin rose from 1,961 tons to 2,164 tons, and stocks from the October figure of 11,237 tons to 11,368 tons. Details of Metal Exchange stocks in official warehouses at the beginning of last week were reported as follows: standard copper down by 175 tons to 14,159 tons; tin up by 144 tons to 9,710 tons; lead up by 245 tons to 7,171 tons and zinc 140 tons higher at 2,059 tons. One way and another, stocks of non-ferrous metals in the U.K. are good, and there is certainly no reason to fear any shortage in the immediate future.

To a greater or lesser degree, values developed an easier trend last week, copper and tin being particularly weak. In fact, the cash quotation for tin dropped to £779, this being £10 below the previous Friday afternoon and actually the lowest level reached since April 1959. With unrestricted exports and consumption not so good as one would like to see it, the outlook is not very wonderful. When the price is below £780, the Buffer Pool is permitted to buy in support of the market, and it remains to be seen what will be done.

To some extent, the drop in the rate of consumption is seasonal, and an improvement may, therefore, be anticipated in the not far distant future. Finally, the week closed with cash at £780 10s. 0d. and three months at £785, the turnover being 605 tons. On balance, there was a loss of £9 10s. 0d. in the prompt position and of £5 in forward.

Trading in futures on the standard copper market last week was active, and the turnover amounted to about 12,500 tons, excluding business done on the Kerb. Following the postponement of strike action at El Teniente for one week, there were hopes that a settlement would be reached, but all hopes of a favourable outcome had virtually been abandoned when, following intervention by the Finance Minister, the employers raised their offer to 15 per cent increase. Within a few hours, this had been accepted by the union and the news flashed to London and New York. At both these centres, the futures markets lost ground, for this outcome was unexpected. Three days later, the American custom smelters reduced their price by 1 cent to 29 cents, and there was even a hint that the producers might follow. Finally, the market closed £6 5s. 0d. down for cash at £218 and £5 10s. 0d. lower for three months at £219 5s. 0d. There was a good deal of bear covering on the market, but the consumers were not thought to have done much buying, for they doubtless thought it was worth waiting for a lower level.

In mid-week, it was reported that the Consolidated Mining and Smelting Co. of Canada proposed to cut their lead output this year by 20 per cent. On a turnover of 9,675 tons, the London market gained 7s. 6d. for cash at £64 15s. 0d., and 10s. for three months at £65 15s. 0d. Zinc was erratic, closing well above the lowest at £79 10s. 0d. cash, but, nevertheless, £2 5s. 0d. down on the week, while at £78 7s. 6d. three months lost 22s. 6d. The turnover was 7,825 tons.

Birmingham

Buyers of raw material are cautious at the moment having regard to the spread of the recession in the motor trade. Recent statements on the situation reveal a more pessimistic view than was taken at the end of last year when it was though that business would pick up by the Spring of this year. It seems that recovery is likely to be delayed to the summer months. Another disturbing factor is the slackness amongst rolling stock makers. Firms in the Midlands which have been busy on contracts for the British Transport Commission are now adversely affected by the cuts in expenditure on the modernization programmes.

A further decline has taken place in the demand for steel sheet and strip, and output of steel generally is not likely to be maintained at the record levels of 1960 unless there is an early revival in the motor trade. Work in the iron foundries has been curtailed to some extent, though there is still a good demand for castings for building work and general engineering. Makers of heavy electrical equipment for power stations at home and abroad maintain a high level of activity. Works producing structural steel are well situated for full production during the current quarter. There is a strong market for plates, sections and reinforcing bars.

New York

Copper futures were steady in moderate trading at the week-end Physical copper was spotty in the dealer and custom smelter sectors. Export sales were reported at 27 cents/lb. F.A.S. Domestic dealer copper was available at 28½ cents, and custom smelter copper at 29 cents. Producer copper was unchanged at 30 cents. Only routine business was transacted. Tin was steadier, following the London market, but quiet. Lead and zinc were slightly active. Scrap copper quiet and steady.

The Aluminum Company of America's 1960 profits were "down very substantially from 1959 levels", according to the company's President, Mr. Lawrence Litchfield, Jr. The statement, appearing in the company's news magazine, added that year-end figures were not complete. In 1959, ALCOA earned $55,570,854 or $2·52 a common share on sales and operating revenues of $858,460,213.

Mr. Litchfield, in an earlier statement, had identified "prevailing low prices and their consequent adverse effect on profits in the face of rising costs" as the aluminium industry's major problem. At the same time, he expressed the hope that "firmer prices at higher levels" could be established in 1961.

It is reported that representatives of U.S. industry are to make a tour of Western Germany in the late spring as part of the United States export drive.

Paris

German, Italian and French interests have formed a joint company for the production of zirconium sponge and ingots. This was announced by Pechiney, the French partner. The German interests are Degussa and Metall-Gesellschaft A.G.; Montecatini is the Italian partner. The new company, Societe Industrielle du Zirconium, with French status and headquarters in Paris, will also develop zirconium applications, especially in the field of nuclear reactors and chemicals.

West Germany

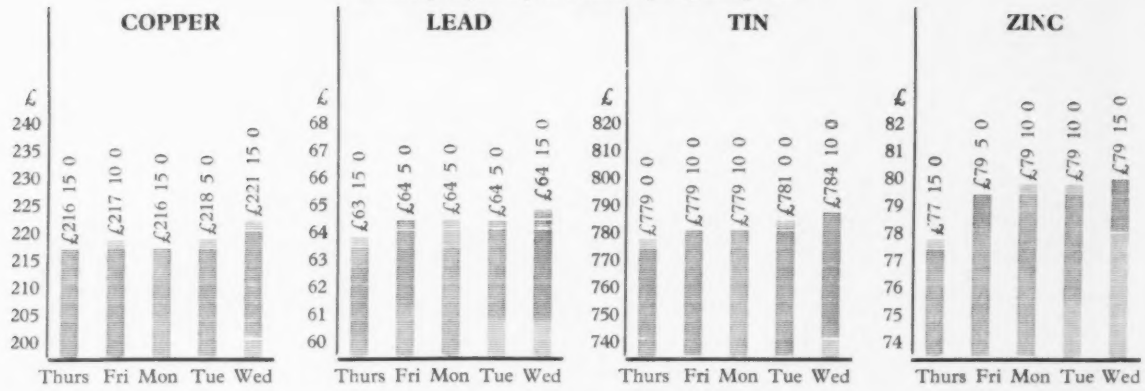
Demand for non-ferrous metal semi-manufactureds in West Germany surpasses the existing volume of deliveries, the Association of North German Metal Semi-Manufacturers stated. The Association does not expect a fundamental change in this situation in the coming months. Delivery terms for a number of products were now longer than 12 months, although the trade had been able to cover their most vital needs from stocks for most of the past year.

Stocks were now being exhausted, and although this meant a danger of rising prices and costs, the profit margin had mainly remained constant, the Association said.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 12 January to Wednesday 18 January 1961



Primary Metals

All prices quoted are those available at 2 p.m. 18/1/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	,,	217	10	0
Antimony Metal 99%	,,	210	0	0
Antimony Oxide Commercial	,,	194	10	0
Antimony White Oxide	,,	196	0	0
Arsenic	,,	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	,,		11	0
Calcium	,,	2	0	0
Cerium 99%	,,	15	0	0
Chromium	,,		6	11
Cobalt	,,		12	0
Columbite	per unit		—	
Copper H.C. Electro	ton	221	15	0
Fire Refined 99·70%	,,	220	0	0
Fire Refined 99·50%	,,	219	0	0

		£	s.	d.
Copper Sulphate	ton	76	10	0
Germanium	grm.		—	
Gold	oz.	12	13	1
Indium	,,		10	0
Iridium	,,	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	64	15	0
Magnesium Ingots	lb.			
99·8%	,,		2	2½
99·9+%	,,		2	3
Notched Bar	,,		2	9½
Powder Grade 4	,,		6	1
Alloy Ingot, AZ91X		1	11¾-2	1¼
Manganese Metal	ton		—	
Mercury	flask	69	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	,,		5	6
Osmium	oz.		nom.	
Osmiridium	,,		nom.	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	,,	30	5	0
Rhodium	,,	46	0	0
Ruthenium	,,	16	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	7⅜
Tellurium Sticks	lb.	2	0	0
Tin	ton	784	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	,,		—	
Virgin Min 98%	,,	79	6	10½
Dust 95·97%	,,	128	0	0
Dust 98·99%	,,	134	0	0
Granulated 99+%	,,	104	6	10½
Granulated 99·99+%	,,	119	12	6

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr kg≏£ ton	**Canada** c lb≏£ ton	**France** fr kg≏£ ton	**Italy** lire kg≏£ ton	**Switzerland** fr kg≏£ ton	**United States** c lb≏£ ton
Aluminium		26.00 215 16	2.43 179 11	370 216 1	2.50 206 5	26.00 207 4
Antimony 99.0			2.30 170 0	495 286 3		29.00 231 2
Cadmium			15.75 1,069 0			150.00 1,195 10
Copper						
Crude				420 245 5		
Wire bars 99.9						
Electrolytic	30.25 223 11	28.50 236 11	3.03 223 18		2.80 231 0	30.00 239 2
Lead		10.00 81 0	.94 69 9	163 95 3	.83 68 9	11.00 87 13
Magnesium						
Nickel		70.00 581 0	9.00 665 2	1,200 699 6	7.50 618 15	74.00 589 15
Tin	108.50 793 0		11.06 817 6	1,480 864 6	9.68 798 12	100.37 799 18
Zinc						
Prime western		12.00 99 12 0				
High grade 99.95		12.60 104 11 0				
High grade 99.99		13.00 107 18 0			1.18 97 7	
Thermic			1.20 88 13			
Electrolytic			1.28 94 13	180 105 2		13.00 104 0

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 18/1/61

	£	s.	d.
Aluminium Alloy (Virgin)			
B.S. 1490 L.M.5 .... ton	210	0	0
B.S. 1490 L.M.6 .... „	202	0	0
B.S. 1490 L.M.7 .... „	216	0	0
B.S. 1490 L.M.8 .... „	203	0	0
B.S. 1490 L.M.9 .... „	203	0	0
B.S. 1490 L.M.10 .... „	221	0	0
B.S. 1490 L.M.11 .... „	215	0	0
B.S. 1490 L.M.12 .... „	223	0	0
B.S. 1490 L.M.13 .... „	216	0	0
B.S. 1490 L.M.14 .... „	224	0	0
B.S. 1490 L.M.15 .... „	210	0	0
B.S. 1490 L.M.16 .... „	206	0	0
B.S. 1490 L.M.18 .... „	203	0	0
B.S. 1490 L.M.22 .... „	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 .... ton	180	0	0
B.S. 1490 L.M.2 .... „	183	0	0
B.S. 1490 L.M.4 .... „	193	0	0
B.S. 1490 L.M.6 .... „	192	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ..... ton	239	0	0
BSS 1400 AB.2 ..... „	247	0	0

	£	s.	d.
***Brass**			
BSS 1400-B3 65/35 .. ton	171	0	0
BSS 249 ..... „	—		
BSS 1400-B6 85/15 .. „	218	0	0
***Gunmetal**			
R.C.H. 3 4% ton .... „	—		
(85 5 5 5) LG2 ..... „	213	0	0
(86 7 5 2) LG3 ..... „	222	0	0
(88 10 2 1) ..... „	273	0	0
(88 10 2 ½) ..... „	285	0	0
***Manganese Bronze**			
BSS 1400 HTB1 ..... „	191	0	0
BSS 1400 HTB2 ..... „	208	0	0
BSS 1400 HTB3 ..... „	227	0	0
Nickel Silver			
Casting Quality 12% „	242	0	0
„ „ 16% „	263	0	0
„ „ 18% „	293	0	0
***Phosphor Bronze**			
B.S.1400P.B.1.(A.I.D. released) ..... „	301	0	0
B.S. 1400 L.P.B.1 „	234	0	0

**Average prices for the last week-end.*

	£	s.	d.
Phosphor Copper			
10% ..... ton	250	0	0
15% ..... „	253	0	0
Phosphor Tin			
5% ..... „	—		
Silicon Bronze			
BSS 1400-SB1 ..... „	274	0	0
Solder, soft, BSS 219			
Grade C Tinmans ... „	359	15	0
Grade D Plumbers .. „	288	5	0
Grade M ..... „	395	10	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.	—		
Type 9 „ „	—		
Zinc Alloys			
BSS 1004 Alloy A .. ton	113	2	6
BSS 1004 Alloy B .... „	117	2	6
Sodium-Zinc ..... lb.		2	6½

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			
Sheet 10 S.W.G. lb.	2	10	
Sheet 18 S.W.G. „	3	0	
Sheet 24 S.W.G. „	3	3	
Strip 10 S.W.G. „	2	10	
Strip 18 S.W.G. „	2	11	
Strip 24 S.W.G. „	3	0½	
Circles 22 S.W.G. „	3	4	
Circles 18 S.W.G. „	3	3	
Circles 12 S.W.G. „	3	2	
Plate as rolled ..... „	2	9½	
Sections ..... „	3	3½	
Wire 10 S.W.G. .... „	3	1	
Tubes 1 in o.d. 16 S.W.G. ..... „	4	3	
Aluminium Alloys			
BS1470. HS10W.			
Sheet 10 S.W.G. „	3	2½	
Sheet 18 S.W.G. „	3	5	
Sheet 24 S.W.G. „	4	0½	
Strip 10 S.W.G. „	3	2½	
Strip 18 S.W.G. „	3	4	
Strip 24 S.W.G. „	4	0	
BS1477. HP30M.			
Plate as rolled ..... „	3	0½	
BS1470. HC15WP.			
Sheet 10 S.W.G. „	4	2	
Sheet 18 S.W.G. „	4	7	
Sheet 24 S.W.G. „	5	6½	
Strip 10 S.W.G. „	4	3	
Strip 18 S.W.G. „	4	7	
Strip 24 S.W.G. „	5	3	
BS1477. HPC15WP.			
Plate heat treated ... „	3	8½	
BS1475. HG10W.			
Wire 10 S.W.G. „	4	0½	
BS1471. HT10WP.			
Tubes 1 in. o.d. 16 S.W.G. ..... „	5	3½	
BS1476. HE10WP.			
Sections ..... „	3	3½	
Brass			
Tubes ..... „	1	9	
Brazed Tubes ..... „	3	0	
Drawn Strip Sections „	3	0½	
Sheet ..... ton	190	5	0
Strip ..... „	190	5	0
Extruded Bar ..... lb.	1	11½	
Extruded Bar (Pure Metal Basis)	—		

Brass			
Condenser Plate (Yellow Metal) ..... ton	179	0	0
Condenser Plate (Naval Brass) ..... „	191	0	0
Wire ..... lb.	2	7½	
Beryllium Copper			
Strip ..... „	1	4	11
Rod ..... „	1	1	6
Wire ..... „	1	4	9
Copper			
Tubes ..... lb.	2	1¾	
Sheet ..... ton	250	15	0
Strip ..... „	250	15	0
Plain Plates ..... „	—		
Locomotive Rods ..... „	—		
H.C. Wire ..... „	269	15	0
Cupro Nickel			
Tubes 70/30 ..... lb.	3	5½	

Lead			
Pipes (London) ..... ton	104	0	0
Sheet (London) ..... „	101	15	0
Tellurium Lead ..... „	£6 extra		
Nickel Silver			
Sheet and Strip 10% .. lb.	3	10½	
Wire 10% ..... „	4	3¾	
Phosphor Bronze			
Wire ..... „	3	11¾	
Titanium (1,000 lb. lots)			
Billet 4½" to 18" dia..... lb.	47	-	48 -
Rod ½" to 4" dia..... „	85	-	53 -
Wire ·036"-232" dia .... „	159	-	99 -
Strip ·001" to ·048" .... „	350	-	68 -
Sheet 8' × 2'. 20 gauge „	73	-	
Tube, representative average gauge ..... „	198	-	
Extrusions ..... „	90	-	
Zinc			
Sheet ..... ton	115	10	0
Strip ..... „	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 17/1/61.

	£
Aluminium	
New Cuttings	139
Old Rolled	109
Segregated Turnings	74
Brass	
Cuttings	154
Rod Ends	138
Heavy Yellow	126
Light	121
Rolled	141
Collected Scrap	125
Turnings	131
Copper	
Wire	194
Firebox, cut up	190
Heavy	190
Light	185
Cuttings	200
Turnings	175
Braziery	170

	£
Gunmetal	
Gear Wheels	190
Admiralty	190
Commercial	174
Turnings	170
Lead	
Scrap	55
Nickel	
Cuttings	—
Anodes	555
Phosphor Bronze	
Scrap	174
Turnings	170
Zinc	
Remelted	70
Cuttings	60
Old Zinc	38

Metal Statistics

Detailed figures of the consumption and output of non-ferrous metals for the month of November, 1960 have been issued by the British Bureau of Non-Ferrous Metal Statistics, as follows in long tons:—

COPPER	Gross Weight	Copper Content
Wire	28,258	27,752
Rods, bars and sections	16,800	11,011
Sheet, strip and plate	16,538	13,175
Tubes	8,763	8,121
Castings and miscellaneous	9,126	—
Sulphate	2,711	—
	82,196	68,168
Of which:		
Consumption of Virgin Copper		53,328
Consumption of Copper and Alloy Scrap (Copper Content)		18,840

LEAD	
Cables	8,594
Batteries	3,181
Battery Oxides	3,419
Tetra Ethyl Lead	2,416
Other Oxides and Compounds	1,891
White Lead	761
Shot	604
Sheet and Pipe	6,400
Foil and Collapsible Tubes	382
Other Rolled and Extruded	775
Solder	1,437
Alloys	2,132
Miscellaneous Uses	1,549
Total	33,541

TIN	
Tinplate	1,145
Tinning:	
Copper Wire	46
Steel Wire	10
All other	74
Solder	147
Alloys	540
Foil and Collapsible Tubes, etc.	54
Tin Compounds, Salts, and Miscellaneous Uses	148
Total Consumption	2,164

ZINC	
Galvanising	9,605
Brass	11,146
Rolled Zinc	2,545
Zinc Oxide	2,401
Zinc Die-casting alloy	4,796
Zinc Dust	1,127
Miscellaneous Uses	978
Total, All Trades	32,598
Of which:	
High purity 99·99 per cent	5,306
Electrolytic and high grade 99·95 per cent	5,730
Prime Western, G.O.B. and debased	13,471
Remelted	561
Scrap Brass and other Cu alloys	4,456
Scrap Zinc, alloys and residues	2,700

ANTIMONY	
Batteries	194
Other Antimonial Lead	66
Bearings	25
Oxides—for White Pigments	107
Oxides—other	85
Miscellaneous Uses	15
Sulphides	5
Total Consumption	497

Antimony in scrap	
For Antimonial Lead	554
For Other Uses	46
Total Consumption	600

CADMIUM	
Plating Anodes	62·35
Plating Salts	17·90
Alloys: Cadmium Copper	3·55
Alloys: Other	3·70
Batteries: Alkaline	7·75
Batteries: Dry	0·60
Solder	14·00
Colours	31·15
Miscellaneous Uses	3·65
Total Consumption	144·65

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

France (new francs per kilo):

Electrolytic copper scrap	(£214.6.0)	2.90
Heavy copper	(£214.6.0)	2.90
No. 1 copper wire	(£203.4.0)	2,75
Brass rod ends	(£160.7.0)	2.17
Zinc castings	(£63.11.0)	0.86
Lead	(£61.6.0)	0.83
Aluminium	(£136.14.0)	1.85

Italy (lire per kilo):

Aluminium soft sheet clippings (new)	(£178.2.0)	305
Lead, soft, first quality	(£79.8.0)	136
Lead, battery plates	(£43.16.0)	75
Copper, first grade	(£207.6.0)	355
Bronze, commercial gunmetal	(£169.1.0)	290
Brass, heavy	(£140.3.0)	240
Brass, light	(£125.11.0)	215
Brass, bar turnings	(£143.1.0)	245
Old zinc	(£56.12.0)	97

Japan (Yen per metric ton):

Electrolytic copper	(£—)	290,000
Copper wire No. 1	(£—)	272,000
Copper wire No. 2	(£—)	256,000
Heavy copper	(£—)	265,000
Light copper	(£—)	215,000
Brass, new cuttings	(£—)	195,000
Red brass scrap	(£—)	223,000

West Germany (D-marks per 100 kilos):

Used copper wire	(£195.1.0)	225
Heavy copper	(£190.14.0)	220
Light copper	(£164.14.0)	190
Heavy brass	(£125.14.0)	145
Light brass	(£86.14.0)	105
Soft lead scrap	(£50.5.0)	58
Zinc scrap	(£47.13.0)	55
Used aluminium unsorted	(£78.1.0)	90

Trade Publications

Flotation in Paints. — British Titan Products Company Ltd., 10 Stratton Street, London, W.1.

Flotation is a phenomenon which has troubled the paint industry for many years and, therefore, the booklet which is now published by the technical service department of this company, under the title of "Flotation in Paints — A Suggested Mechanism", by I. Ferguson, is a welcome piece of research. The paper draws attention to some of the factors affecting the phenomenon. It explains why "cures" sometimes work and sometimes fail. It points out how changes in atmospheric conditions, over which neither paint manufacturer nor paint user has any control, may cause flotation to appear or disappear. At any rate, all technicians who are called upon to face this problem will find this booklet most useful.

Industrial Heat Engineering. — Incandescent Heat Company Ltd., Cornwall Road, Smethwick, Birmingham.

A new bulletin with the above title has just been issued by this company. It covers some 28 pages, and while it is not intended to include all the activities of the incandescent group, the bulletin is designed to give a reasonable cross-section of the kind of work handled by each member company, with illustrations of various types of industrial furnaces and equipment.

Bearing Repair Service. — The Glacier Metal Company Limited, Alperton, Wembley, Middx.

This 16-page brochure is designed to provide details of the Glacier Service Group, which operates through the company's service stations in London, Manchester and Glasgow. At these stations, facilities are provided for the manufacture or repair of bearings up to five tons in weight and between 1 in. and 5 ft. bore diameter. These stations not only reline and machine bearings, but also manufacture new ones for heavy marine and industrial installations. Several illustrations and diagrams are included in the brochure.

Non-Destructive Testing. — Solus-Schall Limited, County Building, Honeypot Lane, Stanmore, Middx.

The current issue of the Solus-Schall News Letter contains several interesting articles dealing with: Inspection in India; ultrasonic section recorder; automatic ultrasonic testing of welds; and the Elastomat. These articles are accompanied by several illustrations, diagrams and statistical data.

Electrical Contacts. — Johnson, Matthey and Co. Ltd., 73-83 Hatton Garden, London, E.C.1.

This company has produced an entirely new version of their publication 1302, "Electrical Contacts". This booklet is intended to help designers of electrical and electronic equipment not only to select contact materials that will perform a given duty with the greatest efficiency and economy, but also to determine optimum contact dimensions and operating force. In addition, it serves as a guide to buyers.

Under the headings "Electrical Conditions" and "Mechanical Conditions" are discussed the general considerations affecting selection of material and design of contacts.

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400,000	2/–	Anti-Attrition Metal	1/3		NIL	4	NIL	1/6	0/9	1/7½	1/–
41,303,829	Stk. (£1)	Associated Electrical Industries ...	42/3	—9d.	15	15	7 2 0	67/3	39/3	67/–	54/–
3,236,424	1	Birfield	55/–		15‡	15	2 14 6	61/–	34/0	75/4½	46/–
4,795,000	1	Birmid Industries	72/–		20	20D	5 11 0	72/9	56/–	75/6	46/9
5,630,344	Stk. (10/–)	Birmingham Small Arms	39/6	—9d.	17½QT	12½	4 8 6	45/6	27/7½	69/–	36/–
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	14/10½		5	5	6 12 3	17/4½	14/10½	17/6	15/–
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/4½		6	6	6 17 3	20/–	17/1½	20/1½	17/9
500,000	1	Bolton (Thos.) & Sons	38/–		10	10	5 5 3	42/3	37/–	47/–	27/6
300,000	1	Ditto Pref. 5%	14/3		5	5	7 0 3	16/–	13/6	16/–	14/9
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18,846,647	Stk. (£1)	British Insulated Callender's Cables	55/6	2/–	13½	13½	4 17 3	61/–	47/6	61/–	45/1½
17,047,166	5/–	British Oxygen Co. Ltd., Ord. ...	26/3		10	10	1 18 0	34/6	19/6	87/9	49/3
1,200,000	Stk. (5/–)	Canning (W.) & Co.	14/3		15+8⅓C	25 + *2½C‡	5 5 3	19/6	13/3	18/1½	12/3
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300,000	2/–	Coley Metals	3/9	3d.	15	15	8 0 0	5/–	3/3	4/6	2/6
10,185,696	1	Cons. Zinc Corp.†	65/6	—2/–	20	15	6 2 3	80/–	60/6	77/3	57/9
5,399,056	1	Davy-Ashmore	133/–	6d.	30‡	20	2 5 0	146/3	100/6	116/–	43/–
7,695,000	5/–	Delta Metal	20/3	—3d.	17½	31‡	4 6 3	28/–	18/7½	26/4½	11/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	48/–	1/–	15	15	6 5 0	56/3	45/–	61/9	36/7½
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1,530,024	1	Ditto A. Ord.	5/4/–		17½F	15'	6 9 0	69/3	55/–	65/6	38/9
1,108,268	5/–	Manganese Bronze & Brass	14/6		20⅝	20⅝	7 3 6	18/9	13/4½	19/–	13/6
50,628	o	Ditto (7½% N.C. Pref.)	6/–		7½	7½	7 10 0	6/6	6/–	7/9	5/9
21,745,110	Stk. (£1)	Metal Box	73/6	5/3	12M	13B	2 19 3	83/–	55/9	80/–	44/7½
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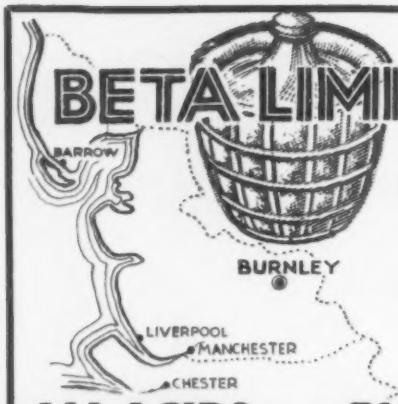

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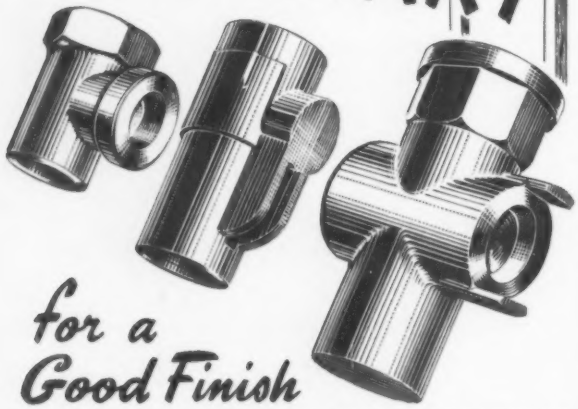

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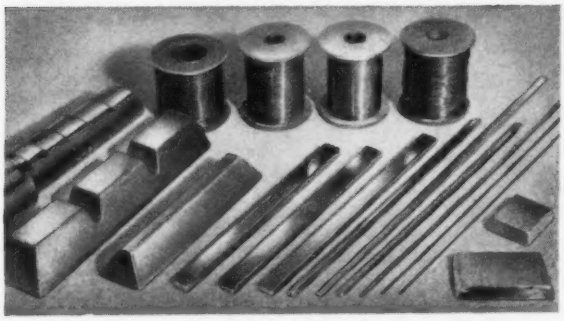

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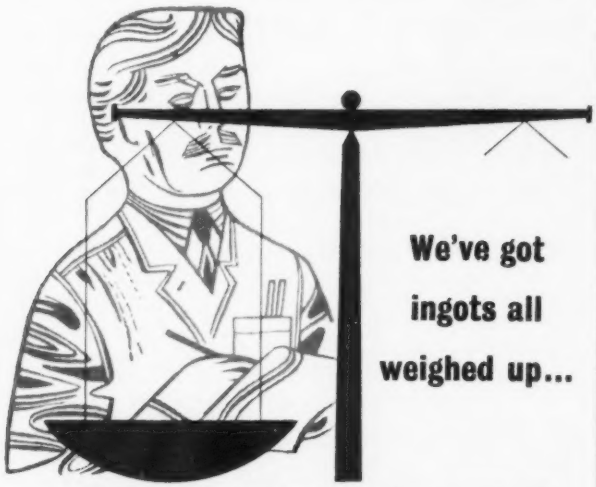

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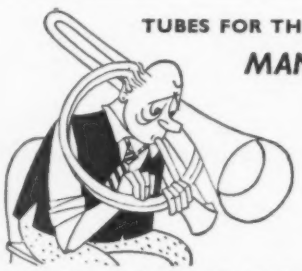

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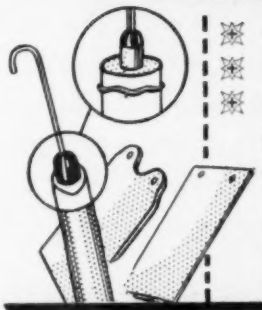

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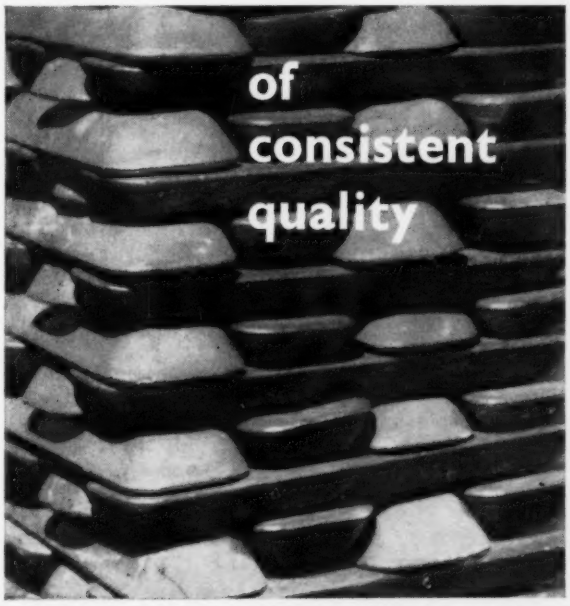

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